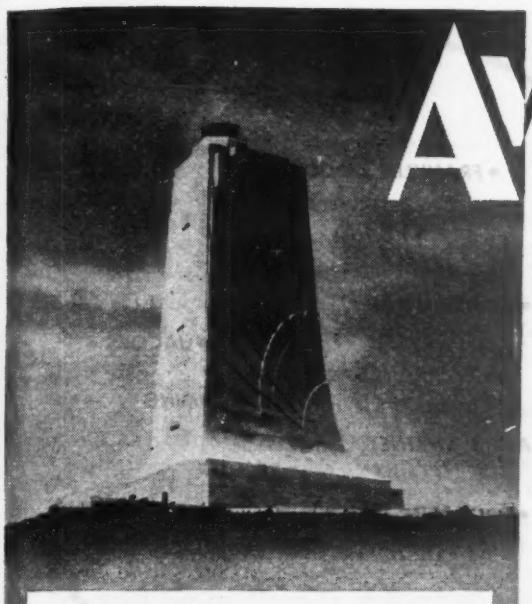


AVIATION

CONTENTS FOR AUGUST, 1945

Volume 44 • Number 8

Briefing for August 5

Down the Years in Aviation's Log 5

Editorial: For *Practical* Glory Try Tail Wheels and Folding Wings 105

Nature Deals a Trump to Marine Airport Designers ..... *Capt. C. H. Schildhauer* 106

It's No Child's Play, Arming and Fueling Carrier Planes ..... *Blaine Stubblefield* 111

Aviation Research—Engineering—Production

Design Analysis of the Fairchild C-82 Packet, I ..... *Irving Stone* 115

Designing Tomorrow's Personal Plane, III ..... *Ralph H. Upson* 140

Analysis of Magnesium Applications in German Aircraft and Equipment ..... *F. A. Rappleyea* 144

Aeronautical Supremacy Demands Jet and Rocket Research, II ..... *Roy Healy* 149

Plant-Practice Highlights 152

Aviation's Engineering Data Book 183

Aviation's Sketchbook of Design Detail 187

For Better Design 193

Review of Patents ..... *A. Harry Crowell* 198

New Products and Practices 223

Aviation Maintenance

Overhaul the Oil Instead of the Engine 155

Inspection and Servicing of Aeromatic Propeller, II 158

Planning the Postwar Overhaul Shop ..... *E. F. Lindsley* 160

Aviation's Maintenance Notebook 162

Civil Operations

Otto Aviation Previews N. J. Base 165

Dust Crops and Reap Profits 166

Marketing

Make It Easy On the Prospect 168

Air Transport

Is CAB Regulation of Airline Securities Necessary? ..... *John H. Frederick* 170

"Elastic Traffic" Plan Advocated for Building Feederline Business ..... *John W. Moore* 171

Coordinated Controls Relieve Pilot Fatigue 172

Military

Improvements Evident in New Jap Seaplanes 174

Flying Equipment

Spartan Building 4-5 Placer for Business Flying 175

Tudor and New Aerovan Groomed for British Airlines 177

Finance

Wall Street Eyes the Lightplane Makers ..... *Raymond L. Hoadley* 179

Side Slips 180

Book Reviews 198

The Aviation News

National Aviation 201
War Communique No. 43 205
Washington Windsock 207
Aviation Manufacturing 209
Transport Aviation 213
Aviation Abroad 216
Financial Notes 219
Aviation People 221

George W. Pfeil, *Publisher* — Leslie E. Neville, *Editor*

John Foster, Jr. ..... *Managing Editor*
Herb Powell ..... *Associate Editor*
Edward E. Thorp ..... *Assistant Editor*
Irving Stone ..... *Assistant Editor*
Raymond Hoadley ..... *Financial Editor*
Erwin J. Bulban ..... *Editorial Assistant*
Chester S. Ricker ..... *Detroit Editor*
Wm. R. Nelson ..... *West Coast Editor*
Blaine Stubblefield ..... *Washington Editor*
Dallas Mallard ..... *Art Editor*
Paul Wooton ..... *Chief of Washington Bureau*

★ ★ ★

On leave of absence With Government Services

Carl Norcross ..... *Colonel, Air Forces*
Charles F. McReynolds ..... *Lt. Col. Air Forces*
Jay P. AuWerter ..... *Major, Air Forces*
Randolph Hawthorne ..... *Major, Air Forces*
Kenneth D. Reynolds ..... *Lieutenant, Infantry*
David Baker ..... *Private, Air Forces*
Don Fink ..... *Special Assignment*

★ ★ ★

Andrew B. Martin, *Sales Manager*

District Managers: Boston, Hunter Snead; New York, Robert F. Boger; Philadelphia, C. M. Edler and E. M. Schellenger; Cleveland, A. H. Bartsch and R. S. Cobb; Detroit, C. W. Evaul; Chicago, A. E. Meanor; St. Louis, W. E. Donnell; Los Angeles, E. W. Potter; San Francisco, John Otterson.

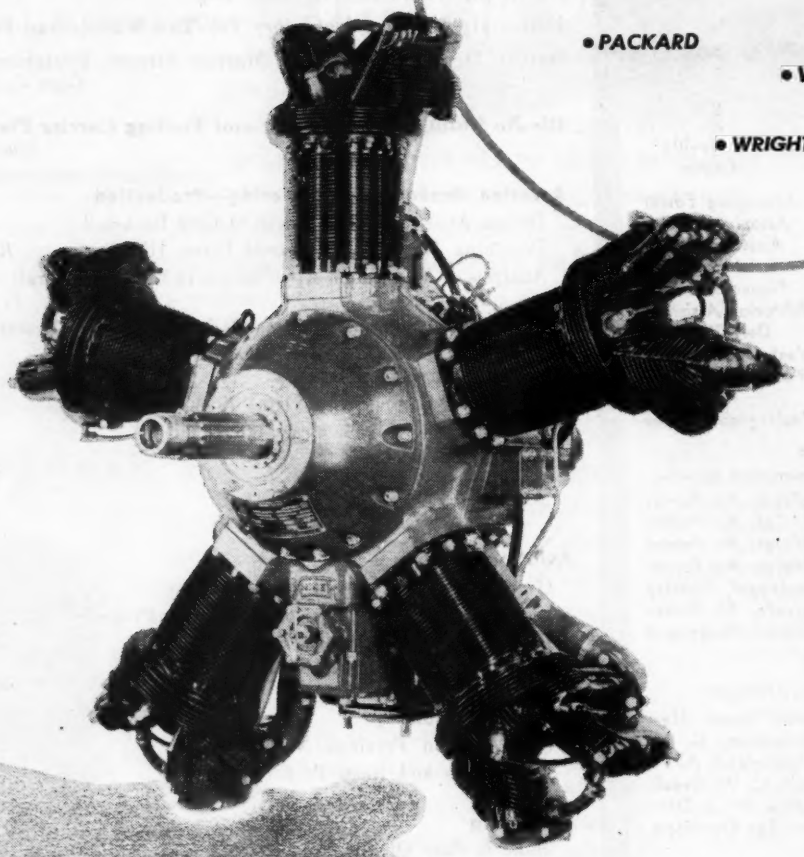
McGRAW-HILL PUBLISHING CO., INC Publication office 99-129 North Broadway, Albany, N. Y. Return postage guaranteed. Editorial and executive offices: 330 West 42nd Street, New York 18, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W.C. 2; National Press Bldg., Washington; 16 South Broad St., Philadelphia; Hanna Bldg., Cleveland; 2980 Penobscot Bldg., Detroit; Continental Bldg., St. Louis; 1427 Statler Bldg., Boston; Rhodes-Haverty Bldg., Atlanta; 621 S. Hope, Los Angeles; 738-9 Oliver Bldg., Pittsburgh. JAMES H. McGRAW, Founder and Honorary Chairman; JAMES H. McGRAW, Jr., President; CURTIS W. McGRAW, Senior Vice President and Treasurer; HOWARD EHRLICH, Vice President (for business operations); JOHN ABBINK, Vice President (for editorial operations); JOSEPH A. GERARDI, Secretary; J. E. BLACKBURN, Jr., Director of Circulation, Aviation, 330 W. 42nd Street, New York. Published monthly, price 50c a copy, 50c in Canada. Allow at least ten days for change of address. All communications about subscriptions should be addressed to Director of Circulation, 330 West 42nd Street, New York. Subscription rates—United States, Mexico and Central American Countries, $3.00 a year, $4.00 for two years, $5.00 for three years. Canada, $3.50 for one year, $5.00 for two years, $6.00 for three years, payable in Canadian currency at par. Great Britain and British Possessions, 30 shillings per year, 60 shillings for three years. All other countries, $5.00 a year, $10.00 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter September 3, 1936, at the Post Office, Albany, New York, under the Act of March 3, 1879. Volume 44, Number 8. Printed in U. S. A. Cable Address, "McGrawhill, New York." Member A.B.C.

Copyright 1945, all rights reserved, by McGraw-Hill Publishing Company Inc., 330 West 42nd Street, New York, N. Y. The contents of this issue may not be reproduced without the permission of the copyright owner. The following publication is combined with AVIATION: AERONAUTICAL ENGINEERING AIRCRAFT JOURNAL. All rights to this name are reserved by the McGraw-Hill Publishing Co.

Aviation is indexed in Readers' Guide to Periodical Literature and in Industrial Arts Index.

Scintilla "sparks" the finest

- FRANKLIN AIRCOOLED
- KINNER
- CONTINENTAL
- JACOBS
- LAWRANCE
- LYCOMING
- PRATT & WHITNEY
- RANGER
- PACKARD
- WARNER
- WRIGHT



Kinner Aircraft Engines . . . good start for future aces. In use on Army trainers for years, Kinner Aircraft Engines have taught thousands of young airmen the meaning of power-plant dependability . . . and the part Bendix-Scintilla* Aircraft Ignition equipment plays in the sterling performance of this and other leading aircraft engines.

*TRADE MARK

SCINTILLA MAGNETO

DIVISION

SIDNEY, N.Y.

PRODUCT OF

Bendix

AVIATION CORPORATION

ARMY E NAVY

Listen to "MEN OF VISION" *Sundays 7 P.M. E.W.T. CBS*

BRIEFING

When the history of our Navy's carrier operations in this war is finally written, you'll undoubtedly see plenty of mentions of the *Bonhomme Richard*, one of the newest and more powerful of the flat-tops, spelling ruin for the Nips. Helping to write that history are a bunch of generally unsung lads who are known as the Service Unit—boys who keep the carrier's planes armed and fueled, AVIATION's Washington Editor, Blaine Stubblefield, was aboard the *Bonhomme Richard* as she headed for the wars, and beginning on page 111 he describes vividly just how rugged and vital is this SU work.

Further proof that the boys aboard the carriers still have plenty of work to do is shown by the type of Jap planes they are knocking out of the sky. On page 174 we present a staff artist's conception of two of the newest Nip floatplane recon jobs—Norm and Rex—which indicate that Hiro's boys are still able to make improvements in their aircraft designs.

In another, and much more pleasant, phase of the water-based aircraft field, we're proud to present a detailed engineering story on marine airport design, written by Capt. C. H. Schildhauer of the Naval Air Transport Service. After citing nature-given economies of seadromes, he gives three schemes for their layout as well as specifications for lane markers. And he also considers the docking and terminal facility requirements. Turn to page 106.

Early last month, Assistant Editor Irv Stone moved into Fairchild's Hagerstown plant, where they're building the new C-82 Packet, to gather material for the 14th in our Design Analysis series. Since this craft is one of the country's newest cargo carriers, and one that presents new trends in design thinking, we are presenting this special study in two parts, the first beginning on page 115 and covering the major airframe components.

At the beginning of the war there were many reports that the Nazis were away out in front when it came to using magnesium in aircraft. 'Tain't so. For F. A. Rappleyea, of the Dow Chemical Co., made an exhaustive analysis of magnesium applications on German liquid and aircooled engines and in radios and he found that even though the Germans evolved many interesting uses of mag and notable production methods, their stuff was no better than ours. His profusely illustrated study begins on page 144.

Data on two more new type aircraft emanating from the British Isles is also presented in this issue—the Avro Tudor I, a four-engine pressurized cabin job designed for trans-Atlantic operations, and the Miles M-56 Aerovan, an all-wood twin-engine craft designed for short-haul work. All available details on these two bids for postwar commercial work will be found in the article on page 177.

A lot of publicity has been given recently to crop dusting, so much so that many people think it's an easy and quick way for an airplane owner or operator to make a lot of money. Well, there *is* good money to be made. But, as is the case with most money-making propositions, the duster is faced with plenty of things to do—and plenty not to do. There's encouragement as well as common sense in our dusting story on page 166.

Featured this month in our regular financial department (page 179) is a special article in which Editor Hoadley continues his precise ranging in market-and-monetary matters. Title is "Wall Street Eyes the Lightplane Makers." . . . And you'll find another special emphasizing finances in our transport department (page 170). This feature points the pertinent question, "Is CAB Regulation of Airline Securities Necessary?"

JOHN W. MOORE, Traffic Manager for Air Transport of the Port of New York Authority, who presents arguments for a new type of certificate for feederlines—certificates that would give now-impossible leeway in schedules and operating points to take full advantage of seasonal variations in traffic volume. He details the case on page 171.

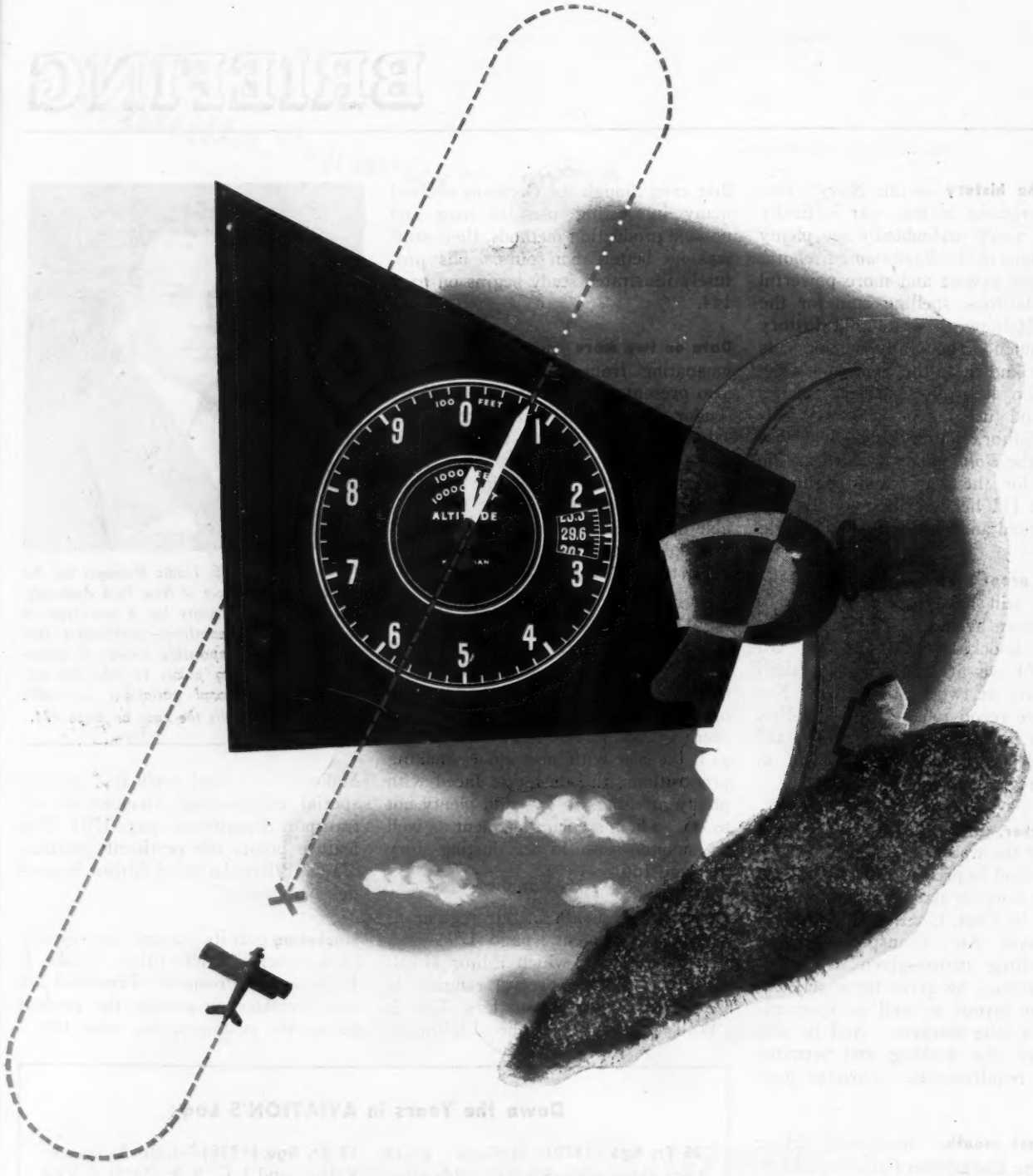
Marketing gets its innings, too—by way of a concise article titled, "Make It Easy on the Prospect." Presented are new wrinkles on getting the product before the customer. See page 168.

Down the Years in AVIATION'S Log

25 Yr. Ago (1920)—McCook Field tests show aircraft serviceable after 100 flight-hours. . . . Germany votes 15,000 marks for Gottingen test lab. . . . Variable compression proves beneficial in altitude engine experiments. . . . Army orders ten twin-Liberty-engined attack planes from Boeing.

15 Yr. Ago (1930)—A flying boat cruise is organized by Detroit Air Yacht Club. . . . Airlines now flying 103,000 mi. daily, over 48,000 mi. of airways. . . . Ford Trimotor is built mounting Packard Diesel aero engines. . . . N. J. State Board of Commerce calls flying boats a menace to navigation. . . . Army inaugurates ferrying of combat planes to C. Z.

10 Yr. Ago (1935)—Lou Levy, of Kellett, and J. G. Ray, Pitcairn, land autogiro carrying mail on roof of Philadelphia Post Office. . . . Boeing completes Model 299 four-engine bomber (XB-17) for Army. . . . Eastern Air Lines orders five Lockheed Electras. . . . Delta opens Atlanta-Dallas service with Stinson Trimotors. . . . Northwest Airlines moves maintenance center from Spokane to Seattle. . . . Senate passes bill forbidding aerial photography of military or naval installations. . . . Congress passes Willcox Bill authorizing Air Corps to establish air bases throughout nation and in U. S. possessions at estimated cost of $110,000,000. . . . Army uses 97 planes in Pacific Coast maneuvers.



FROM THE FIRST BLIND FLIGHT in history when "Jimmy" Doolittle took off, ıade a circuit and returned to his starting point by reference to instruments alone, Kollsman Instruments ave played a vital part in almost all history-making flights. Just as the development of the first Sensitive ıltimeter made possible that first blind flight, other products of Kollsman's continuing research and evelopment in the field of aircraft instruments have played similarly important roles in aviation history.

KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

EDITORIAL

For PRACTICAL Glory
Try Tail Wheels and Folding Wings

BACK IN THE GOOD OLD barnstorming days, when flying was the sport of supermen and there were not enough supermen to make it much of a business, the pilots were a race apart. In fact, the pilot placed himself so far apart from ordinary mortals that he felt it unbecoming to do most of the things that must be done if we are to be successful in busines. Such menial tasks as getting business, keeping books, and controlling costs were far below his dignity.

When summer skies were bright and Sunday drivers thronged his airport, prosperity was his and the day's receipts were quickly squandered. But given a few rainy week-ends or the expense of an engine overhaul or a repair job and the only recourse was to go out and try to find a new angel who would be willing to supply a newer airplane.

The lives of these pioneers, who really laid the groundwork for public acceptance of flying, were merry at times and often they were short. One flight too many in an inadequately maintained airplane was the last flight for many of these old timers who lived so gloriously in the eternal shadow of the sheriff.

WE HAVE COME A LONG WAY since these days of irresponsibility, but we have not come far enough in the direction of sound business methods applied to fixed base operation. Even now many of our operators fool themselves about their costs, then wonder why the tide of red ink is always threatening to engulf them. Only a few have taken time out to sit down and analyze the cost of the many small services the customer expects.

Even fewer have followed such analyses with the necessary steps to trim their costs down to the point where each branch of the service shows a profit. Too many operators are content to take a loss on one item of service, like airplane storage, in the hope that the customer will buy some extra service or some item of equipment which provides the operator with greater profit. And often the customer doesn't play that way.

Hangar rental, for example, is a tough problem for operator and customer alike. An airplane takes up a lot of space, and an ordinary hangar roof is an expensive structural problem because of the wide door openings. The high cost of storing an airplane is a deterrent to plane ownership so serious that all hands should get to work to cut it down. Designers of personal airplanes could enhance their market by perfecting a practicable folding wing craft. Such a plane could be stored much more economically than present types. Operators could then reduce rental charges and still break even or make a little profit on storage, which few of them do at present.

ANOTHER thing: Tail wheels are a must for simplified ground handling, and remember it costs money to push planes around. One successful operator is considering a higher rental rate for planes equipped with skids—thus to encourage their owners to buy substitute wheel equipment to save ground handling costs. The tail wheel is a step in the right direction, but someday an airplane which can be driven around the airport is going to appear and start the less progressive manufacturers scurrying for the licensing rights to the device that makes it possible.

Until we have real taxiability and until prop spinning is as obsolete as the old automobile handcrank we are not going to entice very large segments of the public into the realm of airplane ownership.

These are but a few of the problems that must be solved by teamwork among operators and manufacturers of airplanes, accessories, and equipment. We have passed the stage when designers' efforts could merely be concentrated on developing an airplane that would succeed in getting off the ground and staying in the air for a reasonable length of time. Now we must turn our attention to the seemingly secondary details and refinements that will make plane owning easier and more economical.

Leslie E. Neville

EDITOR

Nature Deals a Trump To Marine Airport Designers*

A
—since the runways are already provided. Thus engineering of the flying boat port is simplified and fundamental economies are indicated. Here the author considers the building, docking, and patrol requirements, presents three schemes for seadrome layout, and gives detailed specifications for cable-connected lane markers.

Itinerant or way station, designed for daylight operation, requires merely a mooring, an amphibious tractor to handle passengers and cargo both on land and afloat, and a terminal building ashore. Indeed, mooring may be omitted if flying boat commander chooses to employ ship's anchor.

By CAPT. C. H. SCHILDHAUER, USNR

JUST AS ARGUMENTS are proffered aiming to support world-route use of landplanes, so, too, many very logical reasons can be put forward favoring broad employment of flying boats and flying ships in global air transport.

Granted, there are specific routes which are inherently favorable to one type or the other. Our contention is that the flying boat offers better scope for the development, via very large aircraft.

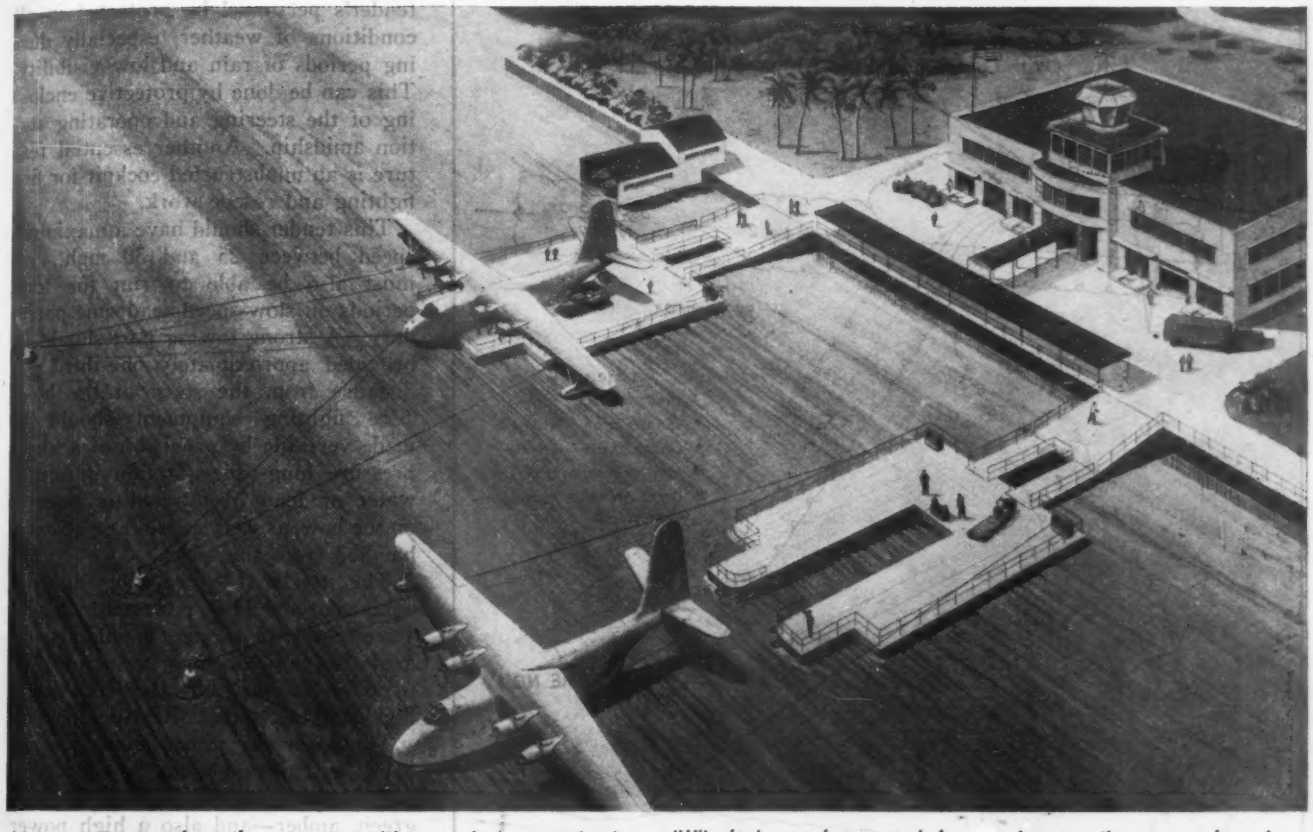
As size increases, the flying boat gains, both in aerodynamic and structural weight efficiencies, more than does the landplane. Any substantial increases in size and weight of the landplane introduces great difficulties in the provision of satisfactory landing surfaces as well as difficulties pertaining to the landing gear on the plane itself; not so with the flying ship.

Any map of world air networks will quickly illustrate how the globe abounds with areas which will enable year-round operation of flying ships.

The future optimum size for any large aircraft, landplane or flying ship, may be 500,000 lb., however, the practical size to handle frequency in world commerce may be approximately 250,000 lb. Studies indicate that an optimum flying ship of 500,000 lb. would require a channel 2½ mi. long, 800 ft. wide, and 12 ft. deep. With such a channel, this flying ship will clear a 50-ft. obstacle at the end of the takeoff area even should one engine fail during this critical period. With jet assisted takeoff, the 500,000-lb. flying ship would require a channel approximately one-half of the above length.

In the realm of the immediate future where flying ships of 200,000 lb. will

* Opinions and representations in this article are those of the author and should not be construed as reflecting views of the Navy Department.



Major stations, such as those to serve cities, require more extensive facilities, as depicted here. Yet outlay still need not be excessive. Seen are shore-connected "U" docks with winch-operated mooring lines, and beyond is small covered dock for seadrome patrol boats.

"U" dock can be moored for use in operating area when shore connection is not practicable. Similar dock could be constructed with arrangement to blow water out of "U" slip with compressed air to enable work on ship's hull.

make their appearance, channels approximately 2 mi. long, 800 ft. wide, and with a depth of 10 ft. are considered ample.

Such water areas require no more surrounding protection than that found anywhere in the Chesapeake or San Francisco Bay areas, where flying boats both small and large have been operating since the initial days of aviation.

A distinct advantage of the land airport would be its location adjoining a seadrome. It will be required that international traffic carried by the large flying ship be distributed to a number of locations by short-haul land aircraft. Conversely, short-haul land aircraft are the feeders of the international flying ship services.

Typical seadromes in actual operation in international air commerce are exemplified by Mills Field at San Francisco (charted in our page 110 illustration) and John Rodgers Airport at Honolulu. Others under consideration are Idlewild at New York City, and Shannon Airport near Foynes, Eire.

England is considering the water off Calshot, on the river just south of Southampton, as a flying ship operating area, with full terminal facilities projected. And an adjoining land airport, on the lower east bank of the mouth of the river, would provide for operation of landplane shuttle services to cities throughout the British Isles.

France, in prewar days, being cognizant of the potentiality of the large flying ship in international air commerce, planned for a system of channels in the lowlands in the vicinity of Paris. The project called for supplying these channels with water from the river Seine. It is also noted that prior to the war Lake Biscarosse, in the vicinity of Bordeaux, was actively used for commercial fiying boat operation. Geneva, Switzerland, would also afford ideal year-'round seadrome facilities for large flying ships. And it may be pointed out that the British have been operating flying boats, with minimum ground investments, from England to Australia and New Zealand.

Thus, throughout the world natural water areas are potential operating areas for waterborne aircraft.

Seadrome Runways

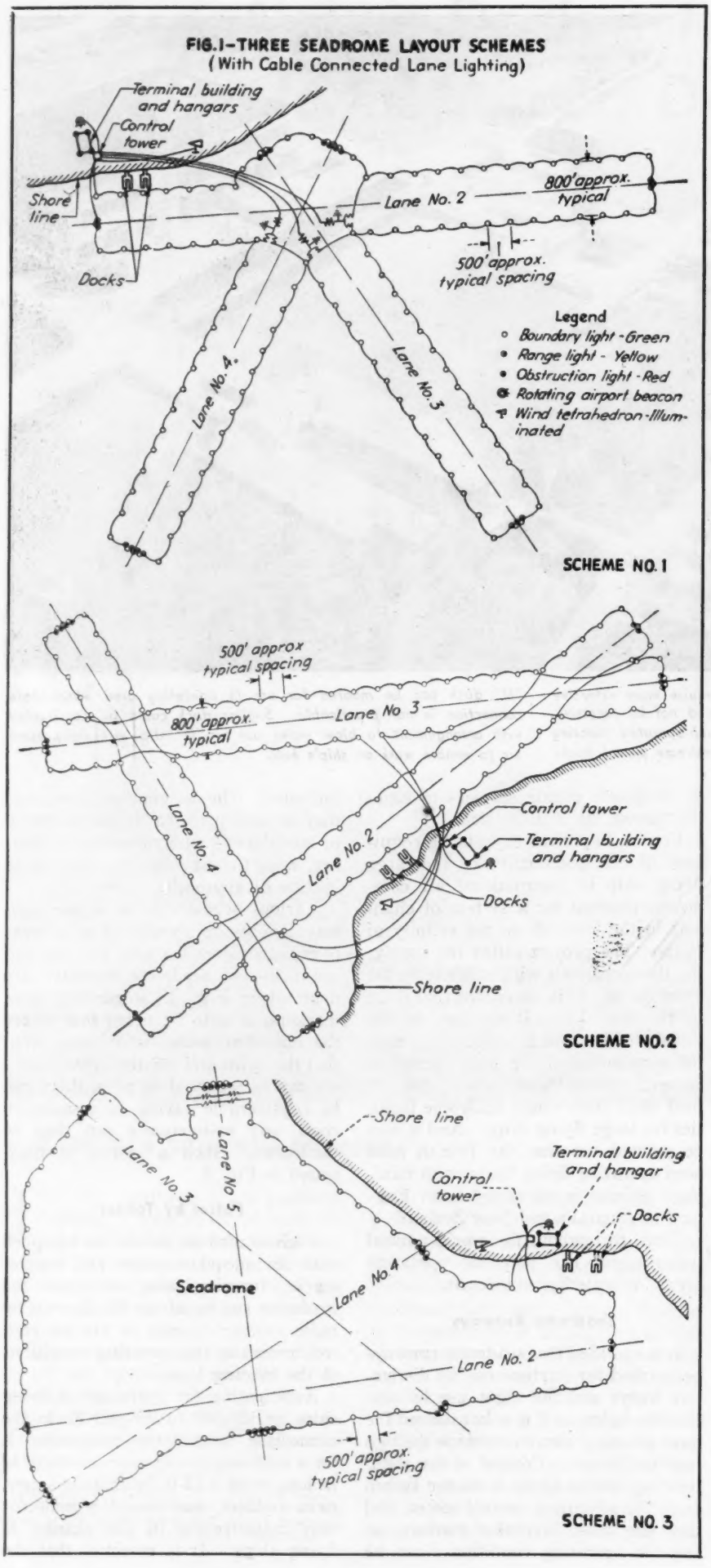
It is specified that seadrome runways be marked for daytime use by distinctive buoys and for night use by distinctive lights, and it is considered the most practical idea to combine the two markers in one. Control of the night lighting system is via a master switch from the adjoining control tower, and thus the most favorable runway, as regards operating conditions, can be indicated. The designation of runways may be similar to that in the operation of landplanes—with reference by number, using the magnetic compass course in line of approach.

Various schemes of seadrome runway layout are shown (Fig. 1, next page) and buoy markers for day and night use of seadrome runways are depicted in Fig. 2. Regarding these markers, it is to be noted that where the operating water is of such depth that the lights and the distinctive markers can be mounted on piles, there can be considerable saving in installation costs, and maintenance can thus be facilitated. Such a system is illustrated in Fig. 3.

Patrol by Tender

Each seadrome should be equipped with an adequate patrol and control tender, function being to patrol the seadrome and to advise the aircraft by radio (either directly or via the control tower) of the operating conditions in the landing lanes.

Anticipating the operation of flying ships of 150,000 to 200,000 lb. in the immediate future, the suggestion is for a seadrome tender approximately 42 ft. long, with a 12-ft. beam, twin screw, twin rudders, and round bottom for easy maneuvering in the vicinity of flying ships. It is essential that the



tender's personnel be protected in all conditions of weather, especially during periods of rain and low visibility. This can be done by protective enclosing of the steering and operating station amidship. Another essential feature is an unobstructed cockpit for fire fighting and rescue work.

This tender should have a maximum speed between 25 and 30 mph., yet must also be able to run for long periods on slow-speed seadrome patrol duty. A strong towing post should be provided approximately one-third the distance from the stern of the boat. Fire fighting equipment should be made versatile by provision of a high-pressure long-range stream of either water or foam from monitor nozzles on the bow, as well as fire-hose streams handled from the stern.

The tender's entire fire fighting equipment should be powered by a separate motor. Provision should also be made for attachment of a suction line to enable pumping of water from partly flooded flying boats or floating docks.

The seadrome tender should, moreover, be equipped with the characteristic rotating identification light—red, green, amber—and also a high power 18-in. searchlight. For communication with aircraft and with control tower, a radio telephone sending and receiving set is required, well protected from spray and moisture in the sheltered cabin. Another "must" would be windshield wipers for operation in rainy weather. Equipment for handling and hoisting mooring and buoys can be installed aft.

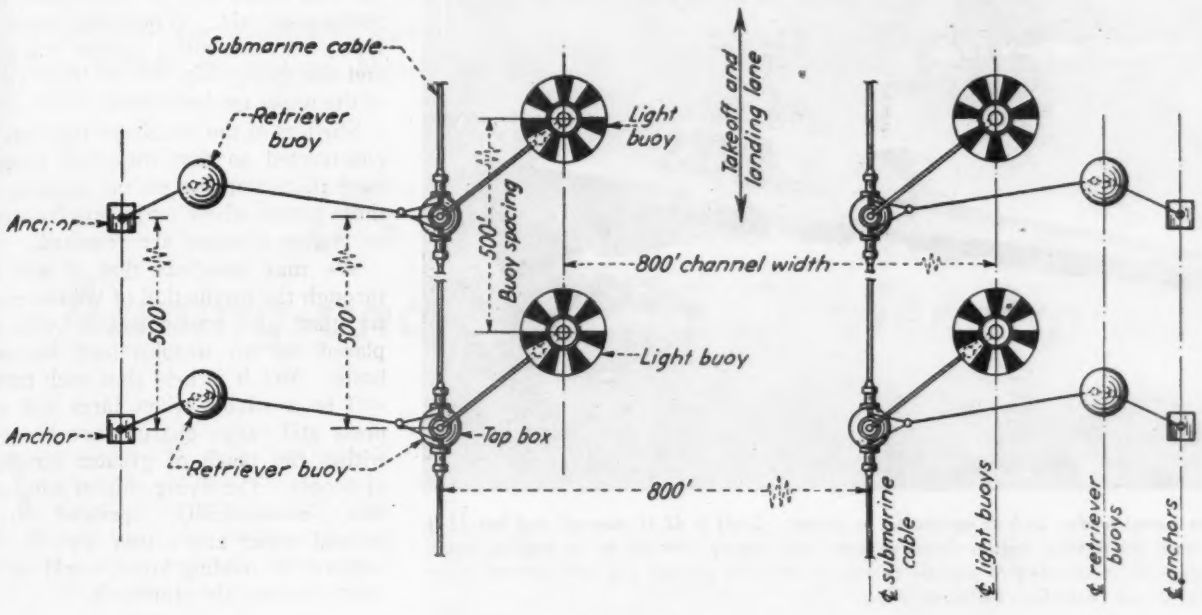
Docking Facilities and Terminal

Flying ship operations can take advantage of the world's natural water facilities. The many lakes and rivers and harbors of North America, South America, Europe, Africa, Asia and Australia are all potential operating areas. These waters can support the smallest of flying-boat yachts or the largest of flying ships without additional expenditures—quite in contrast to the requirements for the operation of the large landplane.

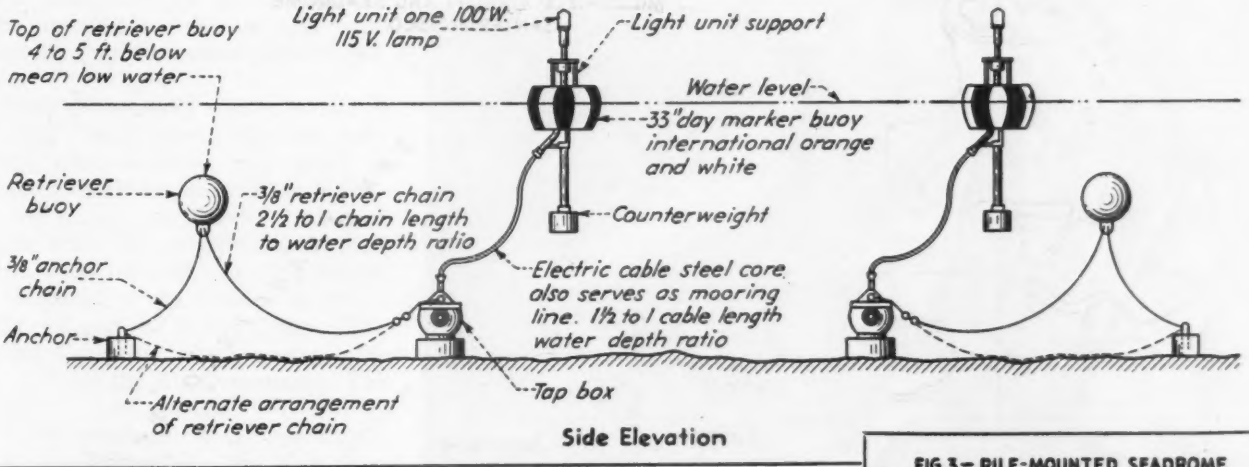
The simplest terminal may consist of merely (1) a mooring placed in position prior to the landing (which may be omitted in event the flying boat employs its anchor); (2) the terminal building ashore; and (3) an amphibious tractor to handle passengers or cargo both on land and afloat. Such a base provides adequate itinerant or way-station service.

Furthermore, to provide the more extensive terminal facilities which are specified to handle the requirements of the major stations serving the larger cities, the outlay still need not be ex-

FIG. 2 – BUOY-MOUNTED SEADROME MARKER LIGHTS



Plan View


Top of retriever buoy 4 to 5 ft. below mean low water
Light unit one 100 W. 115 V. lamp
Light unit support
Water level
33" day marker buoy international orange and white
Retriever buoy
3/8" retriever chain 2½ to 1 chain length to water depth ratio
Counterweight
3/8" anchor chain
Electric cable steel core also serves as mooring line. 1½ to 1 cable length water depth ratio
Anchor
Tap box
Alternate arrangement of retriever chain

Side Elevation

cessive—certainly nowhere near so great as the expenditure involved in construction of a land airport for similarly heavy aircraft.

The flying ship fitted with reversible propellers is readily maneuvered to pick up of the main mooring line, whereupon the ship is hauled in, either tail first or bow first, with the aid of power-operated winches on the dock.

The shore-connected U-dock permits access to the craft from both sides. It further permits the operation of heavy cargo and mail trucks directly to the side of the aircraft for loading and unloading.

Aircraft service stands of a portable type may be stored at the shore end of the dock. The stand can be canopy covered, so that in rainy weather the mechanics and engines are protected.

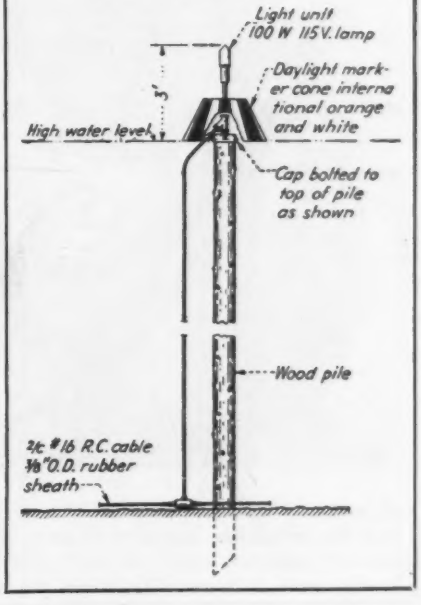
Cooling systems for hot weather areas, as well as heating systems for cold weather, can be moved about the dock and connected to the various compartments to keep them at a comfortable temperature prior to takeoff.

In locations where a shore-connected dock is not practicable, the entire "U" dock can be moored out in the operating area. Under these conditions, power and light as well as compressed air can be supplied by portable units mounted on, or in, the various floating units of the dock. In such cases, the cargo would be handled by boat and can be made available on the dock prior to arrival, as well as taken ashore after departure.

Only infrequently should it be necessary to haul flying ships out of the water. Barnacle formation on aircraft getting high utilization will be almost negligible.

Similar "U" docks can be constructed with a submerged section be-

FIG. 3 – PILE-MOUNTED SEADROME MARKER LIGHT

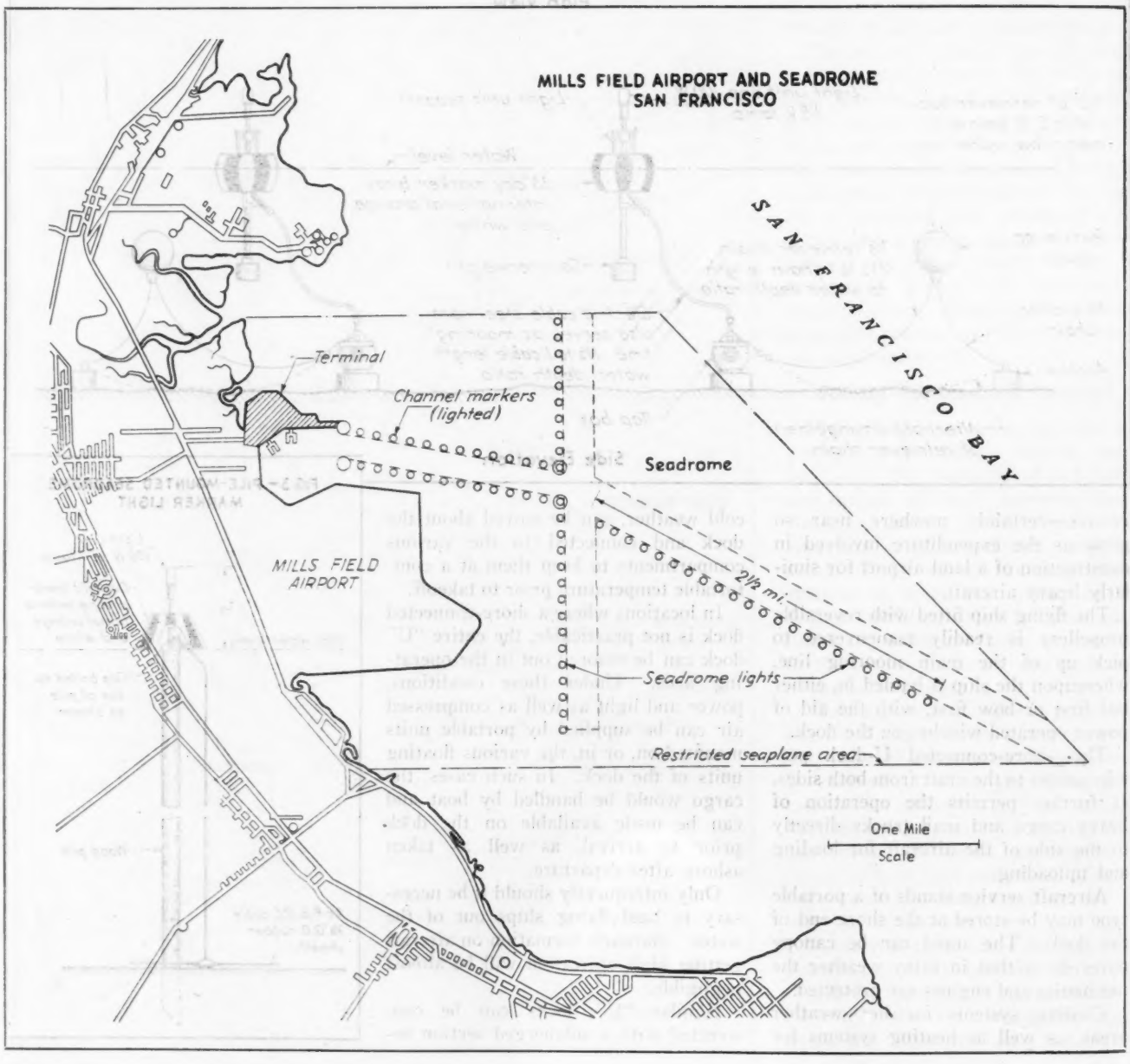

Light unit 100 W 115 V. lamp
Daylight marker cone international orange and white
3'
High water level
Cap bolted to top of pile as shown
Wood pile
2c #16 R.C. cable
⅛" O.D. rubber sheath

Seadrome patrol tender, such as advocated by author. Craft is 42 ft. over-all and has 12-ft. beam. Note fire-fighting nozzles fitted at bow, also towing bitt aft of all-weather cabin. Radio telephone is specified to provide communication with aircraft and with control tower. (Photo by Owens Yacht Co., Baltimore, Md.)

low the open "U", with frames to fit the hull shape and an attachment for compressed air. When the water is blown out, the entire section will rise and the flying ship will be lifted clear of the water for hull work.

Shelters of the cantilever type can be constructed so that they will protect mechanics working on the engines, in those places where major engine work or engine changes are required.

We may conclude that it will be through the production of volume traffic that air transportation will be placed on an unsubsidized business basis. And it is held that such traffic will be available when fares and express and cargo charges are brought within the reach of greater numbers of people. The flying ship of adequate size, economically operated from natural water areas, may well be the solution in enabling broad world use of fast, modern air transport.



An AVIATION correspondent aboard one of the Navy's newest flat-tops follows the rugged, highly skilled Service Unit in action, and finds that —

It's No Child's Play Arming and Fueling Carrier Planes

By **BLAINE STUBBLEFIELD,** *Washington Editor, "Aviation"*

ABOARD THE U. S. S. BONHOMME RICHARD, at sea:—This heavy aircraft carrier's Service Unit has one of the toughest jobs aboard ship, for it is charged with three major tasks which call for plenty of skill, strength, and courage.

First, the Service Unit must service and load all airborne guns; second, it loads bombs, torpedoes, and incendiaries; and third, it fills all aircraft gasoline tanks and operates and maintains the ship's extensive gasoline system.

Since all the costly resources used in building and operating this—and every other—carrier are aimed at bringing its airborne armament to bear on the enemy, the Service Unit men argue with full conviction that their job is one of the most important aboard.

Personnel of the *Bonhomme Richard* are organized in two groups: The Ship's Company, which operates the carrier; and the Air Department. The latter has five sections: V-1, Flight; V-2, Maintenance; V-3, Operations; V-4, Administration; and V-5, Airgroup, which includes the airplane crews.

The Service Unit is a part of V-1, and it has two branches, Ordnance and Gasoline.

Ordnance men must be specialists in more than one type of armament, for between the fighters, dive bombers, and torpedo bombers, three types of guns are used: 50-cal., 30-cal., and 20-mm.

In action an ordnance man of the Service Unit rushes to meet each incoming plane, opens the wing cover, cuts the gun switches and controls, and immediately pulls out the belt of unexpended ammunition. It is a safety measure quickly taken, for potential accidents lurk on every hand aboard a carrier, and they could easily result from airborne guns not disarmed.

One of the principal every-day jobs in airborne ordnance is cleaning and oiling, because the corrosive attack of

Ordnance men of a carrier's Service Unit must be specialists in more than one line, for among fighters, dive- and torpedo-bombers, three types of guns and ammunition are used: 50-cal., 30-cal., and 20-mm. Here AOM 1/c Guy J. Fiore, of U.S.S. Bonhomme Richard, arms Grumman F6F Hellcat with 50-cal. machine gun bullets. (Official U. S. Navy photos)

Carrier Service Unit men emphasize that their duties are as important as any other — for planes without fuel and armament don't win battles. And their work, they maintain, is no less dangerous than any one else's, for they deal with all types of ammunition, bombs, and rockets, as well as gasoline. Here's what happens when an enemy does get through — The U.S.S. Franklin, with blazing gasoline boiling over side, after being hit by Jap dive bomber within 60 mi. of Nip homeland.

salt water on both planes and guns is relentless. Though an every-day task, cleaning and oiling is always a particular job. Moreover, gages of such delicacy are used in checking gun bores that they can indicate approximately how many rounds have been fired from any given barrel.

Special oils are used for different guns, and different oils for high and low altitude operations. Cleaning and oiling must be done daily, whether the guns are fired or not, because effectiveness of a mission and the lives of crewmen depend on this task. All fixed guns have to be harmonized with the sights and the longitudinal axis of the planes to assure convergence at the desired point. This point of convergence is changed for different types of training and combat; but even if no change is made, the alignment of the three elements must be checked. This, it is obvious, is work for experts.

Whereas early airborne machine guns had a high rate of jamming or other failure, such stoppages have proved unusual in this war. Nowadays when a gun jams it is nearly always due to a faulty shell, but the hydraulic charger automatically clears it and the gun goes on shooting. Experienced pilots, like symphony conductors, can spot laggard guns and report which they are to ordnance crews.

In addition to guns, all three types of planes carry bombs of various kinds—general purpose, fragmentation, armor piercing, incendiaries, or depth charges. Only the Grumman Avengers carry torpedoes. Since the bombs carry different fuses for different purposes, the ordnance men must be experts in fuse setting, and they must know the varied suspension fittings in the planes.

Bombs and rockets must be handled with a feather touch; there must be utmost care against accidental explosions on this little airport, because scores and sometimes hundreds of men are directly under and around any given location on the flight deck.

Ammunition, bombs, incendiaries, and rockets are kept in heavily armored magazines below decks. When wanted they are brought part way up on one elevator and then transferred to another. Reason for this arrangement is that there must be no vertical opening directly from topside too far down into the ship through which the enemy might make a lucky deep hit.

Bombs are assembled at the transfer station on the way up. This assembly consists of installing the tail vanes and fuses which are stored at the station. Getting the bombs up to the flight deck is tense, hard, sweaty work—work in which there must be no mistakes and no delays.

Ammunition—called ammo by the citizens of this floating city of fire and power—is not so touchy or dangerous as bombs, and consequently is not stowed so far below. There is always enough within easy reach to meet any need. Seeing ammo being hoisted aboard while the carrier is still at dock would make one think the carrier had been mistaken for a supply ship.

Aerial torpedoes, comparable to the armament employed by submarines, are brought to the flight deck on the airplane elevators. These airborne "torps," like the marine type, have a range of several thousand yards and a speed somewhere near that of the fastest surface vessels. Driven by a combination of compressed air and steam generated by burning fuel acting on a turbine which drives a propeller through a reduction gear, torpedoes are intricate and expensive, accordingly require their own specialists among the Service Unit.

Just beyond limits of the port, on the way out to combat zones, the *Bonhomme Richard* dropped anchor and a huge barge came alongside to start pumping gasoline aboard. The port authority, explained the officer in charge, would not permit fueling inside the harbor—too dangerous.

That word dangerous is the key throughout any discussion of gasoline and its storage and use aboard this carrier and all others. Besides being

Lt. John Baird hails from Idaho and Wyoming, where he was an ardent hunter. Now, as chief of Service Unit, Air Department, aboard U.S.S. Bonhomme Richard, *he directs service and maintenance of huge collection of airborne weapons used for Jap hunting.*

a sizable airport, an enormous hangar, the home of two or three thousand men, and the place of business for dozens of professions and trades, this ship is also a formidable oil tanker.

It carries a trainload of fuel for steam for its four huge driving turbines and can, when necessary, fuel destroyers or other ships. This is in addition to the gasoline required for scores of 2,000-hp. aircraft engines which must not only have enough for long strikes, but thousands of gallons for circling the ship in takeoff and landing order.

Gasoline causes far more demolition and death on aircraft carriers than the enemy does directly with his guns and bombs. From information unofficially given, this writer believes that gasoline fire has caused most of the Navy's carrier losses up to now. Some of these losses have been partly due to lack of experience in the control of gasoline fire, and partly due to fear that gasoline fire is uncontrollable, although, of course nearly all of the serious fires are set by enemy action.

But these losses have not been in vain, for the Navy is learning many things about gasoline fire. It can be smothered with various gases and chemicals; it can be hindered from running and spreading; it can be forced to burn in several small fires instead of one big fire. More important, in many cases it can be attacked so quickly that it cannot get out of control, except where large quantities are involved. Most important of all, gasoline cannot burn unless it mixes with air.

That is the key to the ship's gasoline system. All containers are always completely full of liquid gasoline and filler fluid, and all piping is always completely full of the liquid gasoline, or completely empty of liquid gasoline and vapor and filled with carbon dioxide.

The gasoline tanks, far below decks, heavily bulkheaded and armored, are always completely full. As gasoline is withdrawn from outlets at the top, a filler fluid is pumped in at the bottom. The level of the filler fluid rises as gasoline is used. Pressure is exerted on the gasoline (to drive it up into the dispensing system) by the filler fluid pumps. With use of the filler there is never any air in the tanks to support combustion.

There are many gasoline service outlets on the flight deck, because when the deck is full of airplanes they cannot be wheeled to the fuel. It would be awkward and dangerous to use long hoses.

There are fewer fuel outlets on the hangar deck. Leads to these outlets require special piping, comprising a system which is quite elaborate, judging by the chart in the gas officer's office.

This pipe system is a serious risk, simply because there is so much of it in so many places. It can be broken or ruptured by accidents and by direct hits from the enemy or by the concussion of explosions. After escaping fuel is ignited, closing of the valves is of little avail.

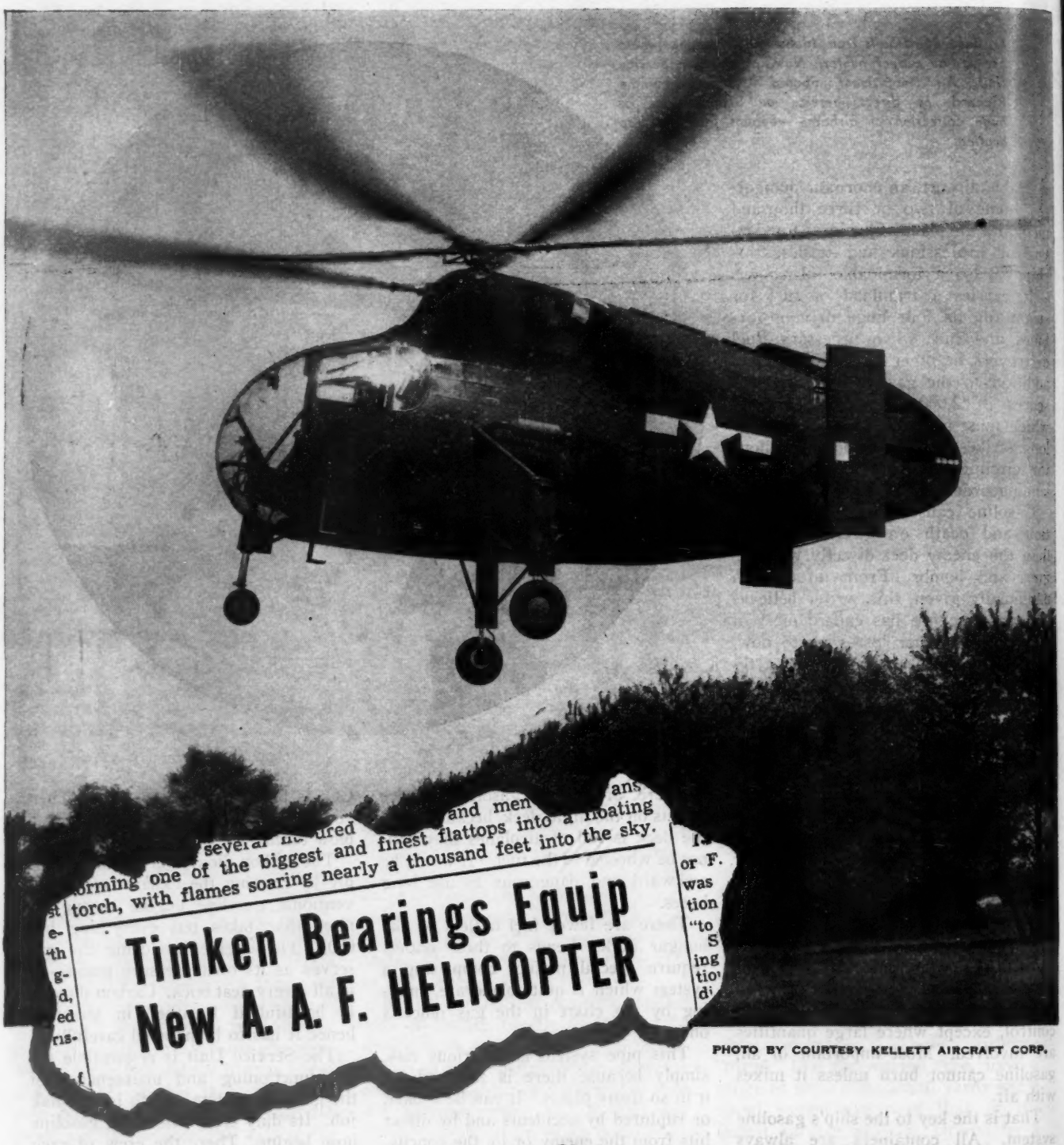
The answer to that problem is to break the piping system down into independent systems; to use only as many of the systems as are necessary; and to keep gasoline out of all piping except when fuel is actually being drawn.

This is done by cutting off the pressure, and letting all the gasoline flow back into the tanks. Then of course the piping is full of gas-air vapor, which is quickly blown out with carbon dioxide gas. When all gasoline vapor is clear and the system is full of CO_2, the valves are closed and the CO_2 is brought up to pressure. Then you couldn't set the piping afire with a blow torch.

The carbon dioxide is produced simply by running the exhaust of a conventional gasoline engine through a filter that takes out everything but CO_2. The engine producing the gas serves as its own pressure pump—all in all a very neat trick. Carbon dioxide is harmful if breathed in quantity, hence it has to be handled carefully.

The Service Unit is responsible for the functioning and maintenance of the gasoline system, which is no small job. Its duty ends where the gasoline hose begins. There the crew of each particular airplane takes over. The idea is to narrow the responsibility down to the human minimum—one man, the crew chief. If anything goes wrong, "he is it." The chief holds the nozzle; a second man holds a potent fire extinguisher; and a third is armed with an enormous mop, with which he quickly sops up any spilled gas.

Assuredly, airplane service afloat is a hard job. As on land, the service boys have to work before the others can start, and they also have to work after the others have quit. And when the planes don't fly, there is the gasoline system to be maintained, and there are also all those hundreds of guns to be cleaned, and inspected, and oiled.



several hundred and men ans
orming one of the biggest and finest flattops into a floating
torch, with flames soaring nearly a thousand feet into the sky.

Timken Bearings Equip New A. A. F. HELICOPTER

PHOTO BY COURTESY KELLETT AIRCRAFT CORP.

Twenty Timken "Aircraft" Bearings equip the new Kellett XR-8 Helicopter—made for the U. S. Army Air Forces—at twenty vital points of its main drive and wheels.

Part of a series developed to meet the need of aircraft engineers for an anti-friction bearing with lighter weight and compact design, Timken "Aircraft" Bearings also assure maximum radial and thrust load-carrying capacity . . . smoothness of operation . . . economical maintenance . . . and ease of operation . . . as well as power conservation and endurance.

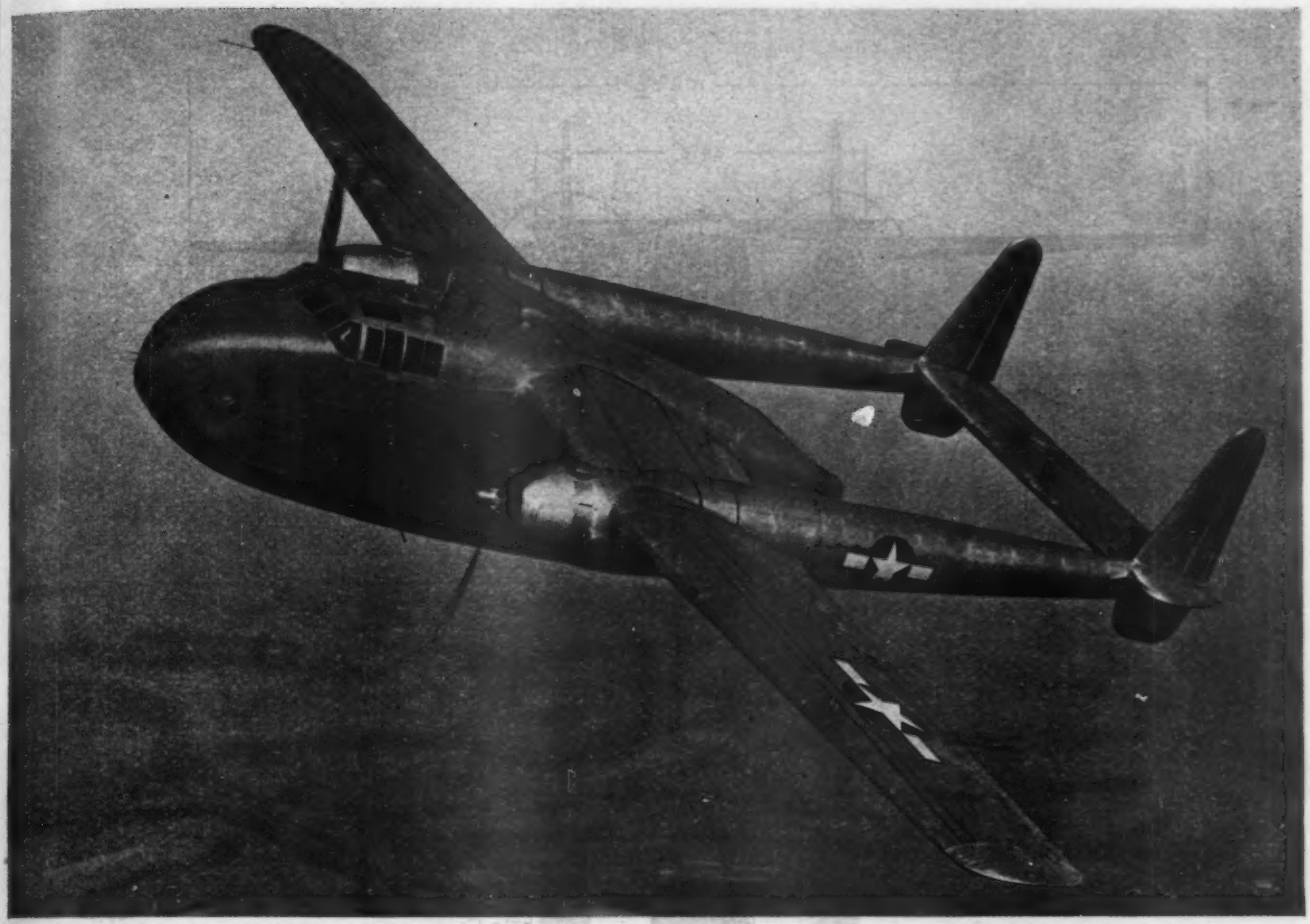
If the many matchless qualities of Timken Bearing design for aircraft applications can help, consult us. We'll be glad to make recommendations. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

The "TIMKEN" Trade-mark is a good thing to look for . . . a protection to find.



DESIGN ANALYSIS OF THE

FAIRCHILD C-82 PACKET

PART I

By **IRVING STONE**, *Assistant Editor, "Aviation"*

Beginning a comprehensive two-part study of Fairchild's war-born long-range aerial freighter — a fast plane designed around extensive cargo space and affording immediate practical utility for post-war hauling. . . . The 14th analysis in AVIATION'S lucid series.

WHEN the rear cargo doors of the Fairchild C-82 Packet swing open, it is impossible to keep one's thoughts on the craft's technical aspects — the almost unbelievable space visible commands all attention. For what is seen is a substantially rectangular 2,870-cu. ft. room actually larger than some rail boxcars. Also, by providing for end-loading, the design eliminates the 90-deg. turn involved in side loading, and thus accommodates longer cargo with facility.

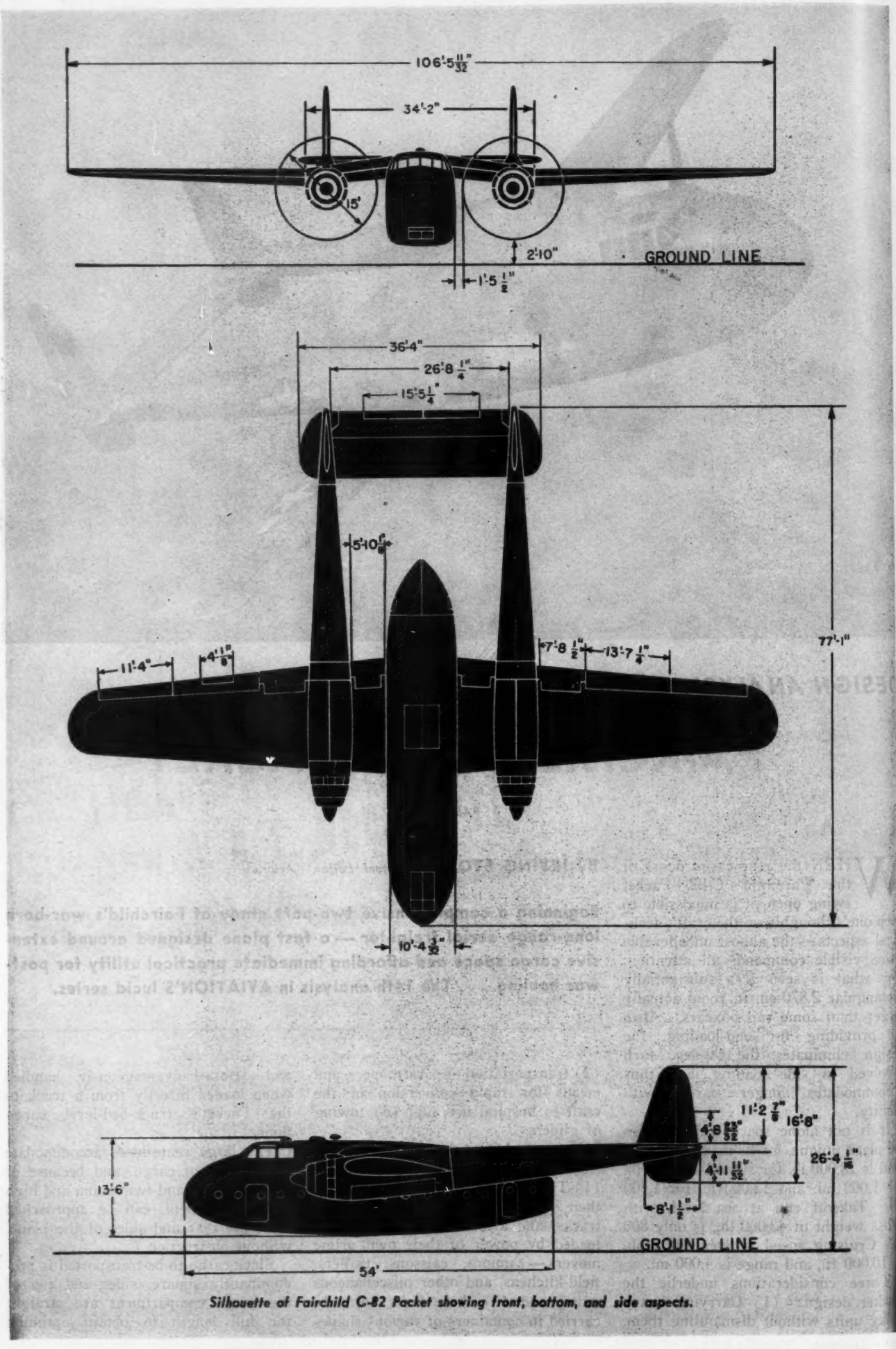
It is not alone space which makes the plane unique, for its maximum payload is 18,000 lb. for 500 mi., 15,500 lb. for 1,000 mi. and 13,000 lb. for 1,500 mi. Takeoff run at sea level, with gross weight of 42,000 lb., is only 800 ft. Cruising speed is over 200 mph. at 10,000 ft., and range is 4,000 mi.

Three considerations underlie the Packet design: (1) Carrying heavy bulky units without dismantling them, (2) transportation of paratroopers, and means for rapid conversion of the craft to hospital use, and (3) towing of gliders.

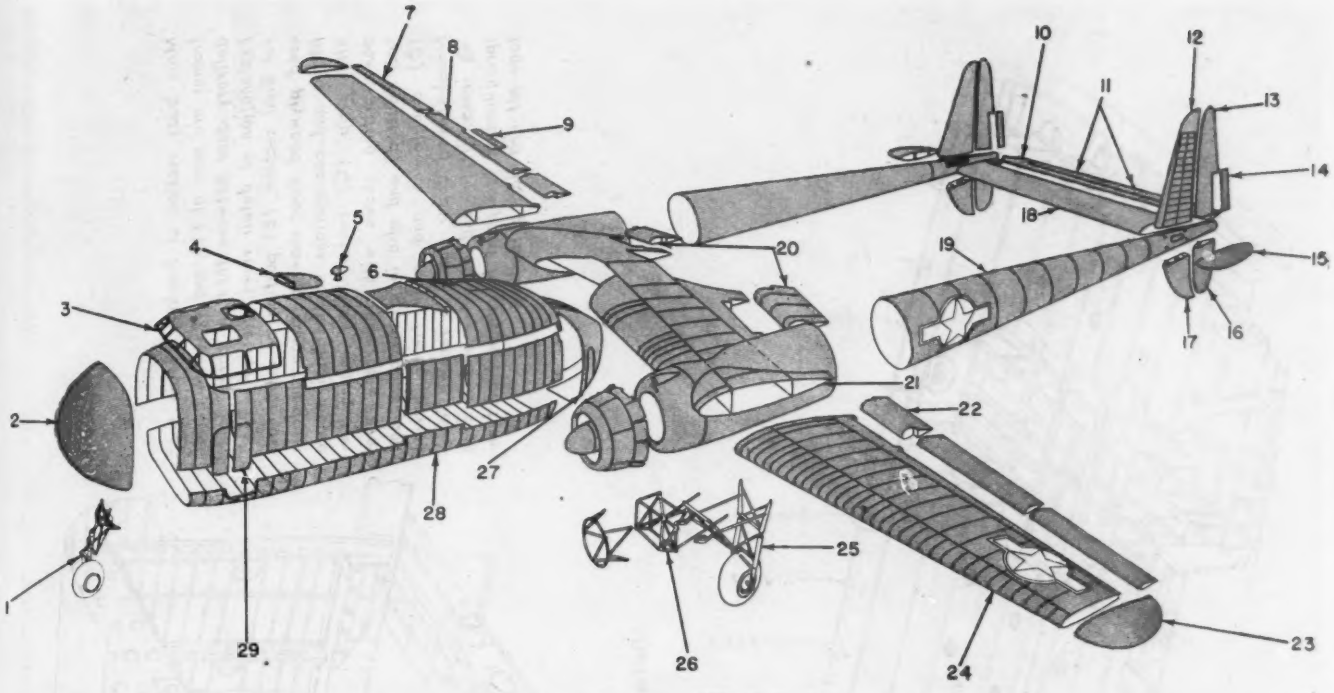
Units to be transported were considered to fall into three categories: (1) Those which could be loaded under their own power — trucks, tanks, half-tracks, and armored cars; (2) those loaded by power of their own prime movers — cannons, caissons, trailers, field-kitchens, and other miscellaneous units; and (3) those units normally carried in containers of various shapes and sizes — advantageously handled when loaded directly from a truck to the Packet's truck-bed-level cargo floor.

The large rear doors accommodate these types of cargo, and because of the high wing and twin boom and high tail arrangement, can be approached from the rear and sides of the plane, without obstruction.

Since cargo to be transported is predominantly square, sides and top of the cargo compartment are straight for full length to obtain optimum



Silhouette of Fairchild C-82 Packet showing front, bottom, and side aspects.



Exploded view showing: (1) Nose gear, (2) nose section, (3) cockpit enclosure, (4) scoop, (5) antenna, (6) life raft door, (7) outboard aileron, (8) inboard aileron, (9) tab, (10) elevator, (11) tabs (spring and trim), (12) upper fin, (13) upper rudder, (14) tab, (15) stabilizer tip, (16) lower rudder, (17) lower fin, (18) stabilizer, (19) boom (20) inboard flaps, (21) wing center section, (22) outboard flap, (23) wing tip, (24) outer panel, (25) main landing gear, (26) nacelle structure, (27) rear cargo door, (28) fuselage main body section, and (29) front cargo door located below cockpit floor.

volume usefulness for the airplane.

Use of tricycle landing gear places the cargo floor horizontal for its full length.

Loading is facilitated by two ramps, adjustable to the tread of equipment being loaded, and brought together at the center, they form a single ramp unit suitable for loading litter or seat patients.

As a troop carrier, the Packet affords simultaneous egress for two lines of paratroopers, and coupled with its low controllable speed, permits more than twice the usual concentration of aerial troopers in a given ground area.

In the center of the cargo floor, a door bay permits the dropping of aerial delivery containers carried on rails with electrically operated shackles releasable by pilot or jump-master.

Straight walls of the cargo compartment simplify mounting of supports for litters five tiers high, with sufficient space in the center portion of the fuselage for movement of medical personnel and equipment.

Material of construction in the Packet is generally 24ST Alclad, except for higher strength alloy in various highly stressed members.

Fuselage Main Body Section

The Packet fuselage — 54 ft. long and approximately 10 ft. wide and 13 ft. high — is of semi-monocoque construction and consists, generally, of main and auxiliary frames, stringers, beams, and skin. To facilitate construction, the fuselage has been resolved into six major sections — main body, sides, upper front, upper rear, nose compartment, and rear cargo door compartment.

Main body section — foundation of the fuselage — supports the cargo floor, is composed of frames, stringers, and longitudinal and transverse floor beams, and is approximately 40 ft. long from point of nose attachment to cargo door hinge point. From bottom of floor to bottom contour it varies in thickness from 9 in. at its ends to 20 in. at the center. Main frames — except for main spar frames — are spaced approximately 35 in. apart. Main spar frames are so designated because they fall directly below the wing center section spars, and are spaced 72 in. apart.

Main frames of the main body section are U-shaped web beams with straight upper chord members and vertical chord stiffeners. Lower chord members are hydropressed contoured C-sections. Web gages vary from .025 to .040 — the latter being at the main spar frames. Upper chord members vary from .032 to .064, and stiffeners are rolled angle sections with gage varying in accordance with thickness of web.

At the end of the main body section the main frame has a double web or box construction. Upper chord is trough-shaped, .072 thick, and is designed to receive upper fittings of loading ramps. Web members are .032 and are reinforced by vertical channel stiffeners. Lower chords are .064 formed angles to which a plate is riveted to complete the box section. At outer ends of the frame, just outboard of the outboard longitudinal beams, cast fittings are provided to receive spring-loaded jack-points to afford support for aft end of the fuselage while it is being loaded.

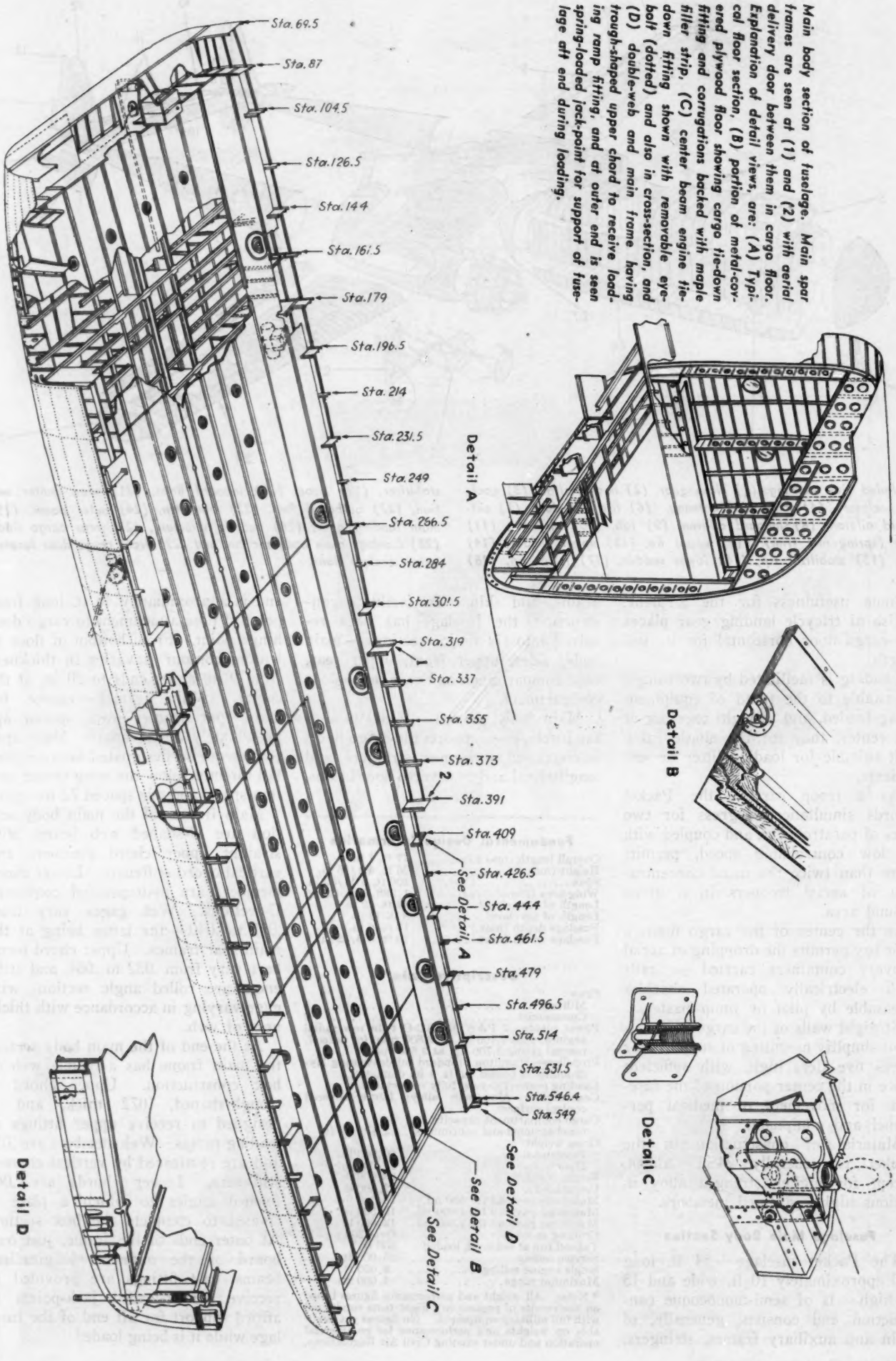
Fundamental Design Information

Overall length (max.)	77 ft. 1 in.
Height (max.)	26 ft. 4 1/16 in.
Span	106 ft. 5 11/32 in.
Wing area (less ailerons)	1,288.7 sq. ft.
Length of root chord	17 ft. 10 in.
Length of tip chord	8 ft. 11 in.
Fuselage depth (max.)	13 ft. 6 in.
Fuselage width (max.)	10 ft. 4 3/32 in.

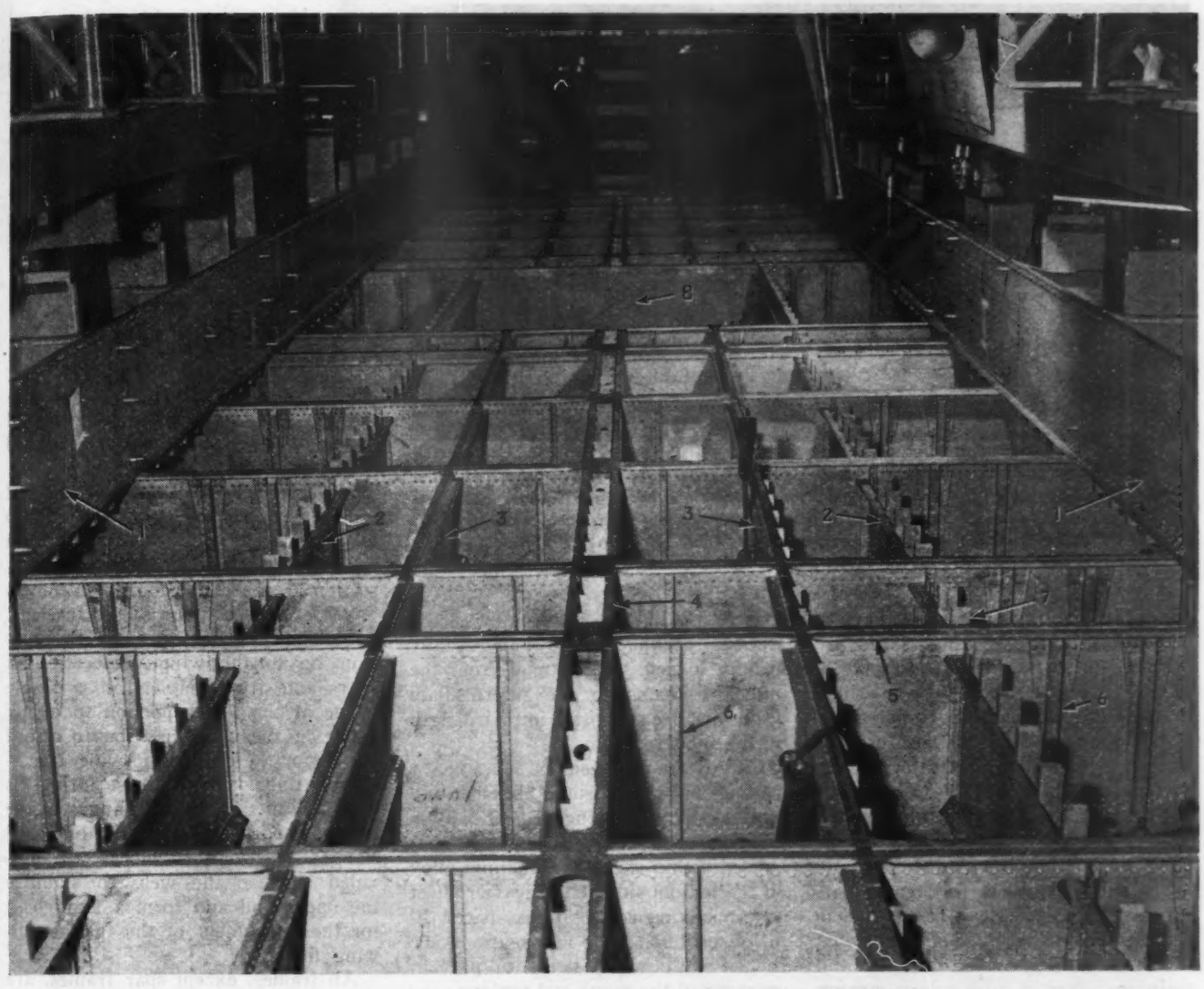
Descriptive Data*

Crew	
Military	5
Commercial	2
Power plants—2 P&W R-2800-C twin row radial engines, each 2,100 hp. at 2,800 rpm. for takeoff, normal rating 1,700 hp. at 2,600 rpm.	
Propellers—Hamilton Standard full-feathering Hydromatic, 3 blades, 15 ft. 1 in. diameter.	
Landing gear—Tricycle, fully retractable.	
Construction—Aluminum alloy; fabric covered control surfaces.	
Cargo compartment capacity (unobstructed and continuous)	2,870 cu. ft.
Gross weight	
Provisional	50,000 lb.
Design	42,000 lb.
Empty weight	28,000 lb.
Useful load	22,000 lb.
Maximum payload for 500 mi.	18,000 lb.
Maximum payload for 1,000 mi.	15,500 lb.
Maximum payload for 1,500 mi.	13,000 lb.
Cruising speed	Over 200 mph.
Takeoff run at sea level, loaded	800 ft.
Service ceiling	25,000 ft.
Single engine ceiling	8,000 ft.
Maximum range	4,000 mi.

* Note: All weight and performance figures based on the results of preliminary flight tests conducted with full military equipment. No figures yet available on weights and performance for commercial operation and under existing Civil Air Regulations.



Main body section of fuselage. Main spar frames are seen at (1) and (2) with aerial delivery door between them in cargo floor. Explanation of detail views, are: (A) Typical floor section, (B) portion of metal-covered plywood floor showing cargo tie-down fitting and corrugations backed with maple filler strip, (C) center beam engine tie-down fitting shown with removable eye-bolt (dotted) and also in cross-section, and (D) double-web and main frame having trough-shaped upper chord to receive loading ramp fitting, and at outer end is seen spring-loaded jack-point for support of fuselage aft end during loading.



View of main body section looking aft, showing longitudinal beams and frames: (1) Outboard beam, (2) inboard beam, (3) intermediate beam, (4) center beam, (5) main frame, (6) web stiffener, (7) channels for tying in transverse hat-sections, and (8) aerial delivery container opening with center beam removed.

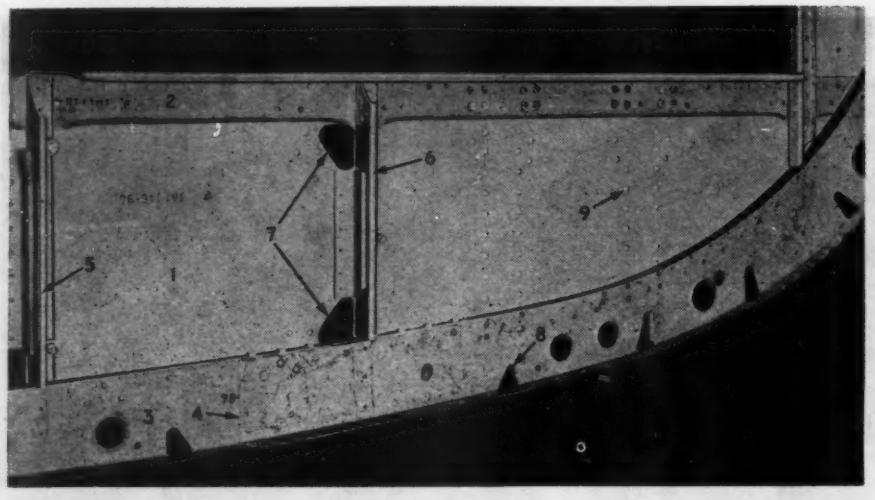
Auxiliary frames are constant depth C-sections varying from .025 to .032, with the heavier gage between spar frames, and are located between main frames to reduce the length of skin panels to approximately 17 in.

Main body section has 7 longitudinal floor beams, two outboard, two inboard, two intermediate, and one at the center. Outboard beams, 96 in. apart, are located above the floor, the beam on the right side running the full length of the cargo compartment, and that on the left extending from the rear cargo door frame to the front entrance door from where it runs forward below the floor. The beams are of web construction of constant height, with rolled angle upper and lower chord members, and tapered channel-section vertical web stiffeners. At typical section, beams are 15 in. deep with .020 webs and .051 chord members. The vertical stiffeners are extended beyond the lower chord member to provide anchorage for the outer ends of the transverse floor beams. Lower chord rests on and is riveted to main frame upper chord members, and the web of the outer beam is riveted to the vertical stiffener which forms the inboard edge of the U-shaped main frame. Web of each beam has cutouts for attachment of eight ventilators. At ventilator cutouts, the web is increased to .040, and an additional drop-hammered section is used to stiffen the beam.

Inboard beams, fabricated in lengths to fit between main frames, are located below the floor and spaced approximately 54 in. apart. They have web construction with rolled angle upper and lower chord members and vertical web stiffeners. Typical section has .040 web, .060 upper caps, and .040 lower caps. The webs are riveted to the vertical web stiffeners of main frames. Chord members on either side of main frames are made continuous by joining with a splice plate which passes through an opening in the main frame web. Lower chord of the inboard beam follows the contour of the main body section, is spliced for continuity, and passes through notches in the lower chords of main and auxiliary frames.

Intermediate beams—also located below the floor—are made up in sections to fit between main frames and are spaced 30 in. apart. They are web beams, with upper and lower chord members spliced for continuity, and have vertical web stiffeners. The beams have a constant depth of 10 in. and do not extend to the contour. Typical section has a .032 web and .051 upper and lower caps.

Center beam is similar in construction to the intermediate beam but instead of a single web, has two webs spaced by channel stiffeners. The beam is designed to take loads imposed on it by the spare engine hold-down fittings used for bolting power plants mounted on cradles or to receive eye bolts for lashing other heavy cargo.



Portion of main body section main frame: (1) web, (2) upper cap, (3) lower cap, (4) splice plate, (5 and 6) angles for web attachment of intermediate beam and inboard beam, respectively, (7) upper and lower cutouts for inboard beam caps, (8) stringer cutout, and (9) attachment of hat-section stiffener on reverse side of web.

Hold-down fittings are cast, have a center boss and two flanges, and are designed to sustain a load of 5,000 lb. in any direction. The boss is drilled to receive a steel bushing tapered for a ¾-in. bolt, and the flanges provide means of attaching the fitting to the center beam web.

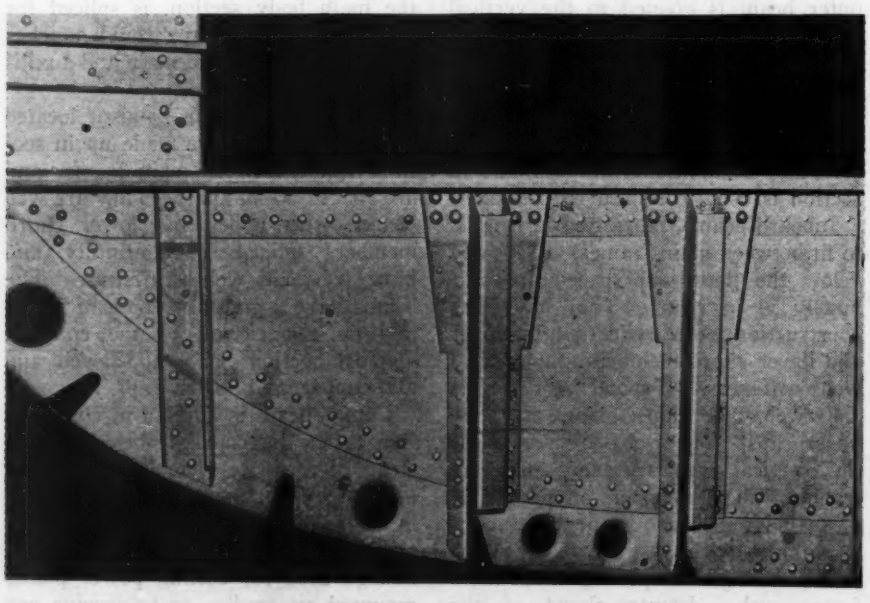
Between main spar frames, the center beam is removable and is equipped with fittings at upper and lower chord members to engage mating fittings on the spar frames. The beam is secured by four bolts and when it is removed, the inboard beams and main spar frames form a box-opening approximately 52 in. wide by 72 in. long for dropping aerial delivery containers.

Transverse floor beams are hat-sections, generally of .032 gage, and are spaced 5.8 in. on centers. Used in sections of the cargo floor usually heavily loaded, they extend from the outboard beams to the intermediate beams and are supported in their length by the inboard beams.

Cargo floor — designed for heavy loading and to withstand abrasion and impact — is constructed of 3-ply Douglas fir plywood core to which is bonded a thin sheet of aluminum alloy on the bottom side and a heavier sheet on top having corrugations spaced 10 in. on centers. The corrugations are backed with maple strips to prevent crushing of the metal and prolongs the life of the floor by facilitating the sliding of cargo. Between corrugations the floor is coated with non-skid paint.

To facilitate fabrication and maintenance, the floor is constructed in removable sections. Over the aerial delivery opening in the fuselage center, the floor consists of two doors, hinged at outer fore-and-aft edges to the inboard beams, designed to withstand the same degree of loading as the floor proper.

Spaced on 20 in. centers in the floor is a pattern of hold-down fittings, each provided with ring and stud for lashing cargo, and designed to sustain an upload of 1,250 lb. and side load of 500 lb.



Corner of main frame. Hat-section stiffeners are shown at center.

Fuselage Sides

For ease of fabrication, fuselage sides—consisting of main and auxiliary side frames, longitudinal stringers, and skin—are constructed as separate units.

Main side frames have flanged holes and beaded webs, rolled lip angles placed back-to-back to form the inboard chord members, and C-section outboard chord members formed to the contour of the fuselage.

Side spar frames provide the tension tie to the wing center section spars and are tapered from a single frame at the lower portion to a box frame at the upper portion to afford a base for the fuselage-to-wing attachment fittings. One of these fittings is mounted on the inboard flanges of the frame, and the other to the outboard flanges. Cast spacer blocks are provided between the webs to stabilize the upper end and form a rigid base for the attachment of the fuselage-to-wing fittings.

All frames, except spar frames, are notched to permit installation of continuous rolled bulb angle stringers.

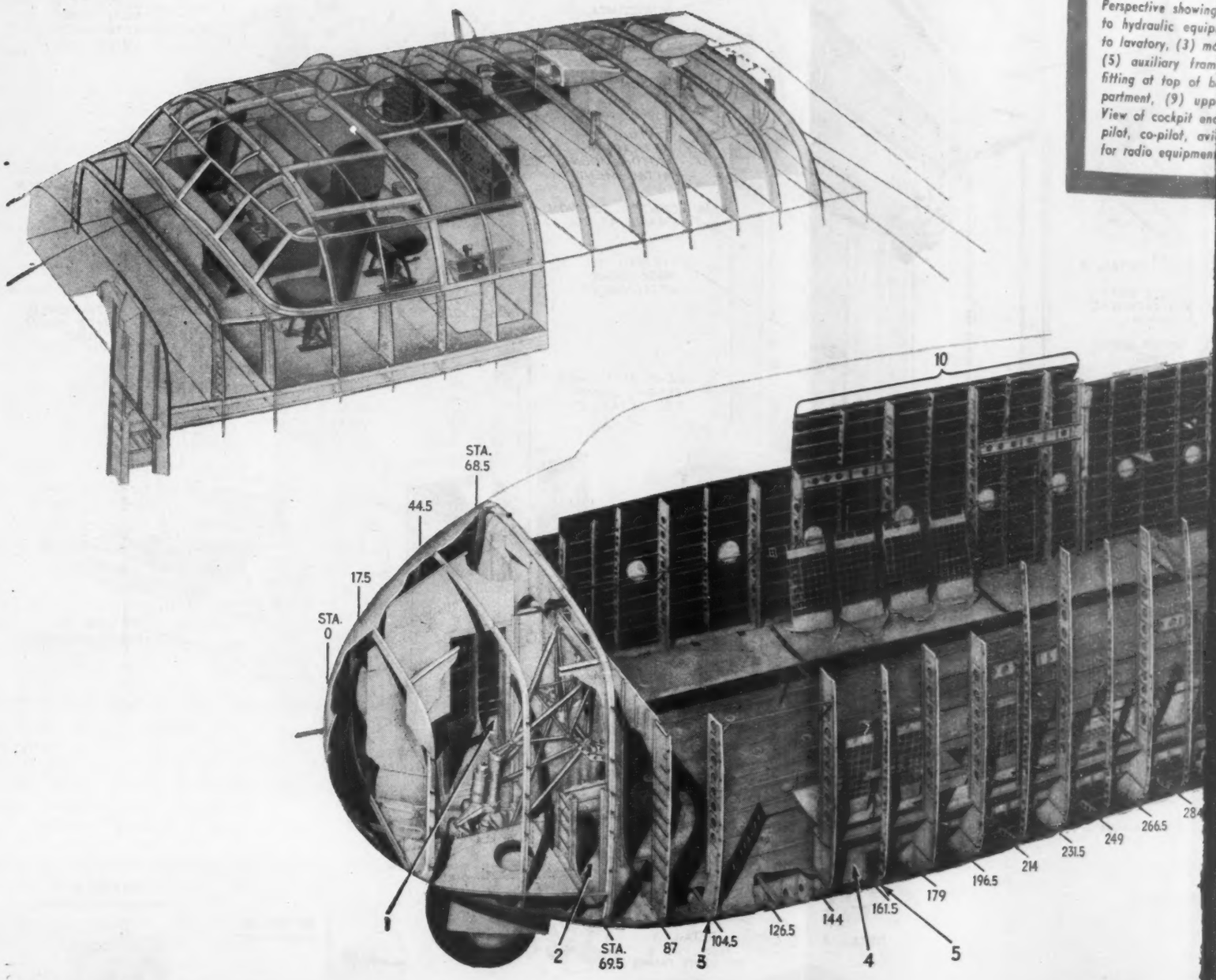
Twelve 9-in. holes provided in the skin for flush mounting of circular windows are reinforced by an angle on the inside.

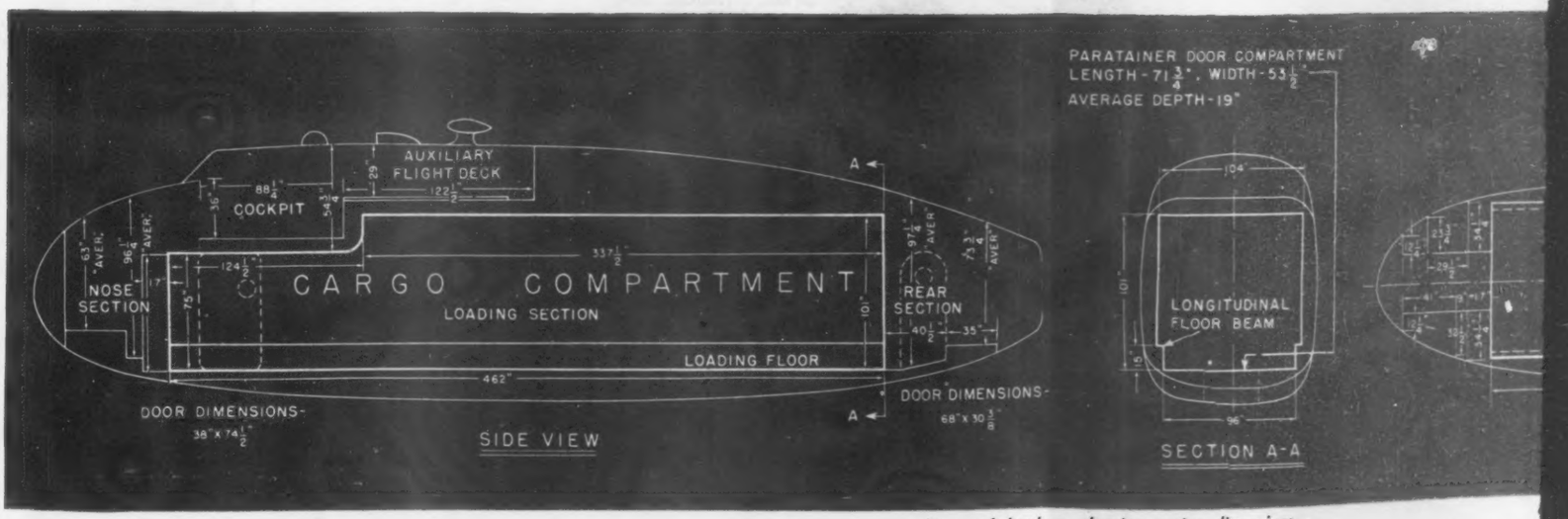
Fuselage Upper Front Section

The upper front section is located between the end of cockpit floor, at station 196½, and the wing center section front spar, at station 319. It consists of a series of arched frames to which horizontal beams are riveted, longitudinal stringers, skin, intercostal fore-and-aft beams, and a covered corrugated floor for accessories.

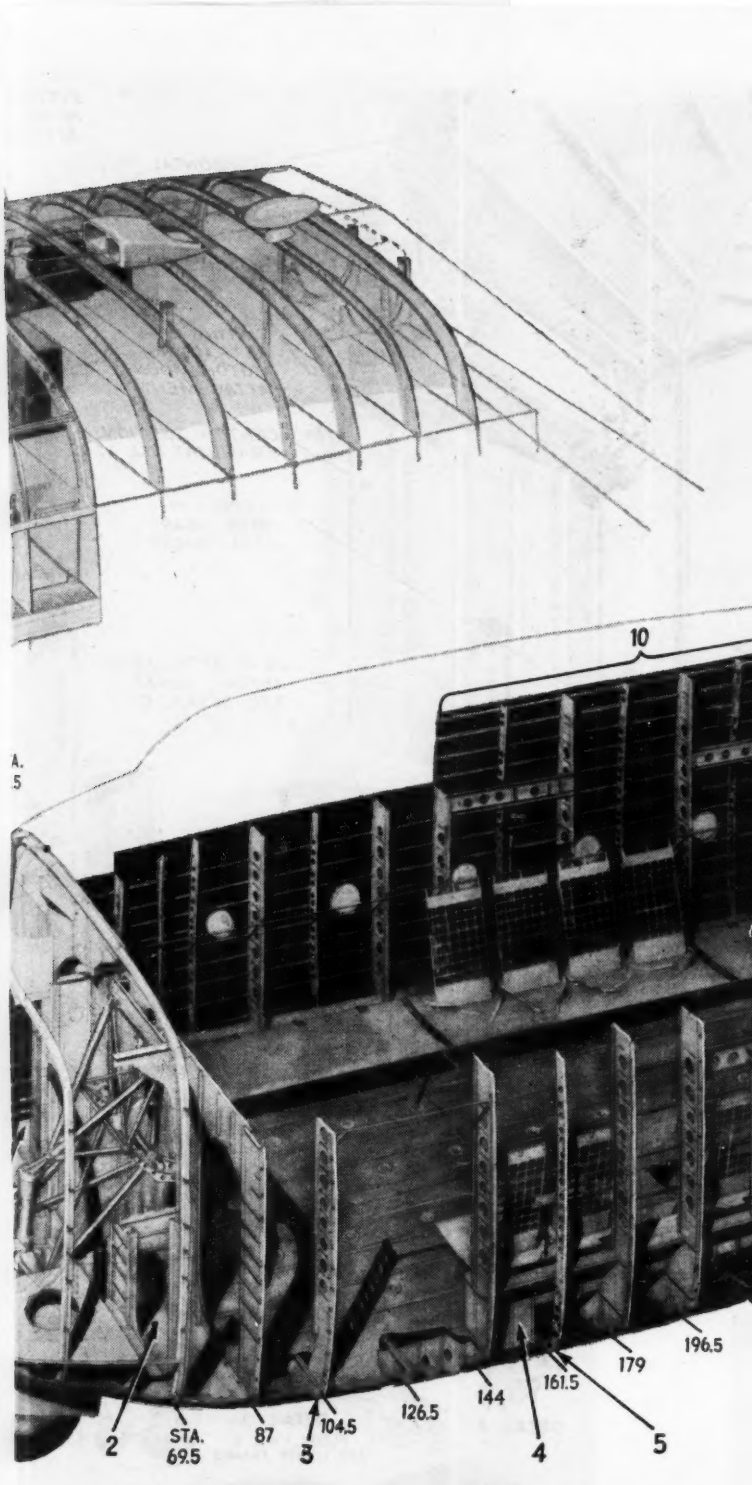
The arched frames are pressed C-sections with return lip on the inside flange and flanged holes in the webs, and at a typical section, main frames are 4½ in. deep, auxiliary frames are 3½ in. deep, and frame gage is .032. The horizontal floor beams are built-up I-members having .020 web and a depth of 5 in. at typical section. Fore-and-aft intercostal beams are C-sections with return lip on both upper and lower flanges and flanged holes

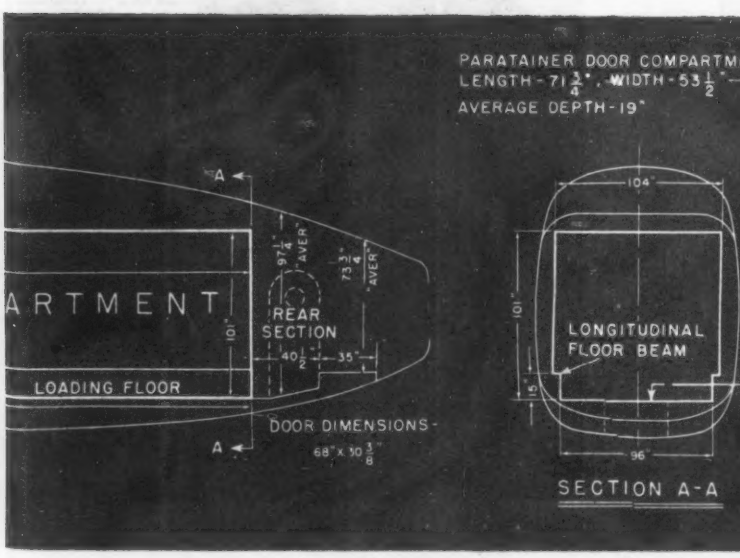
Perspective showing
to hydraulic equip
to lavatory, (3) ma
(5) auxiliary fram
fitting at top of b
partment, (9) upp
View of cockpit en
pilot, co-pilot, avi
for radio equipmen





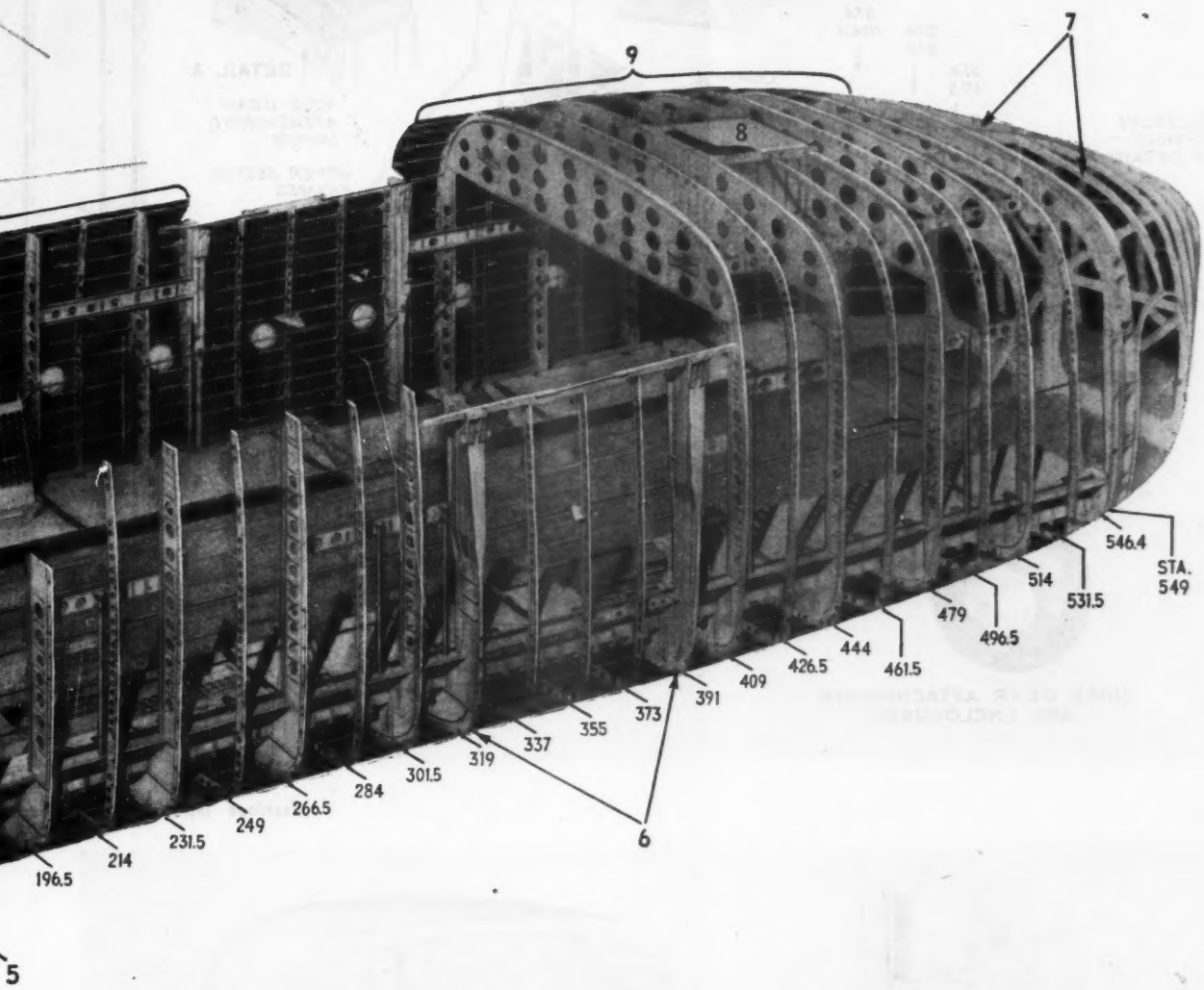
Views of fuselage showing major dimensions.

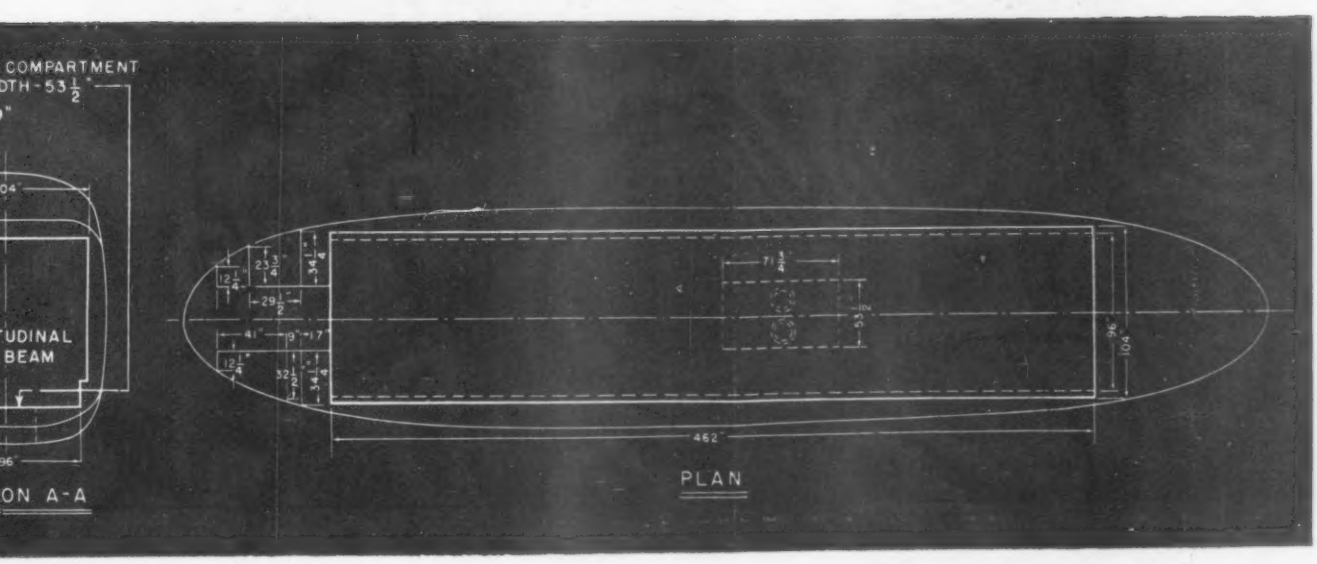




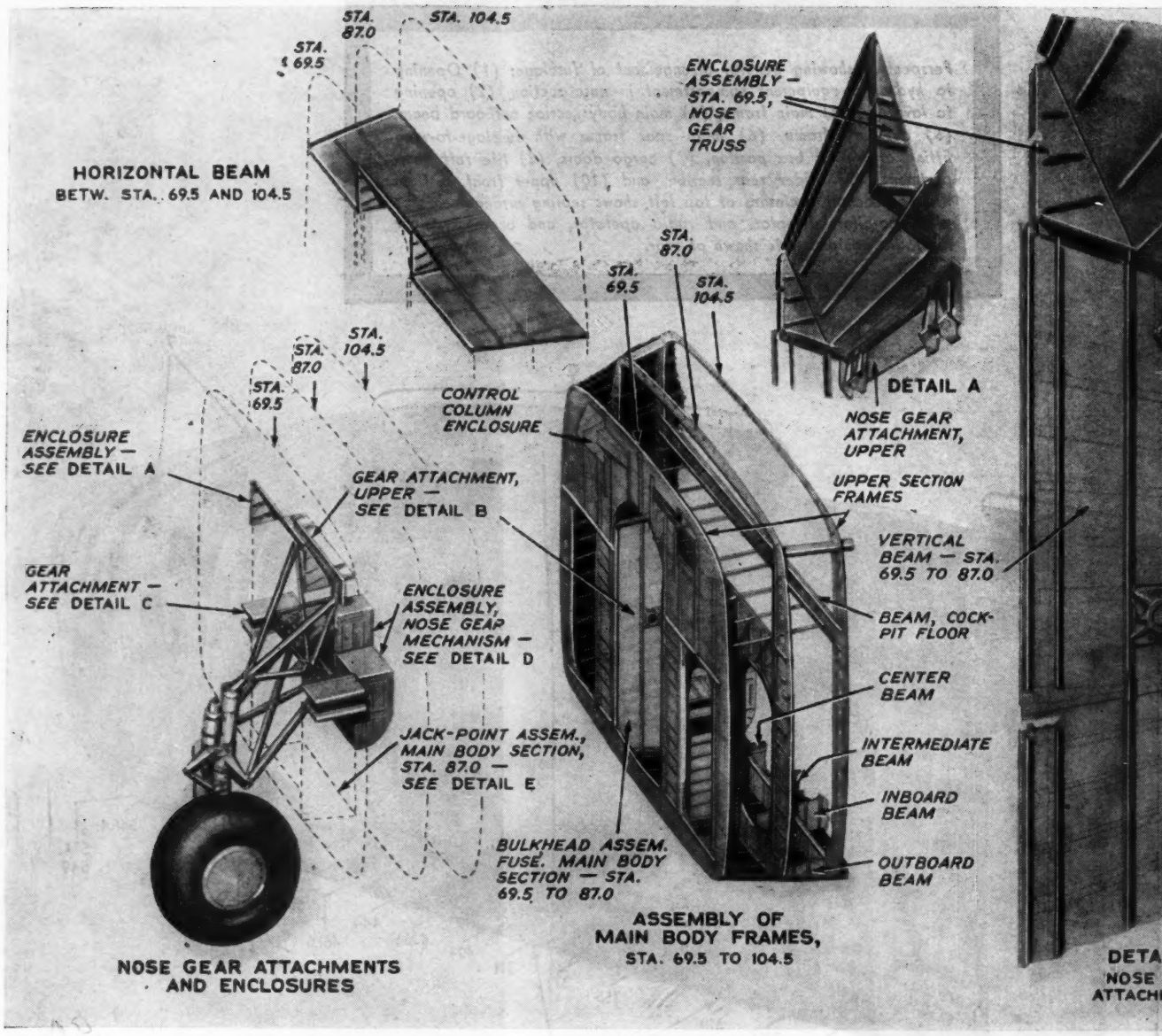
Views of fuselage showing major dimensions.

Perspective showing general arrangement of fuselage: (1) Opening to hydraulic equipment compartment in nose section, (2) opening to lavatory, (3) main frame, (4) main body section outboard beam, (5) auxiliary frame, (6) main spar frame with fuselage-to-wing fitting at top of box portion, (7) cargo doors, (8) life raft compartment, (9) upper rear section, and (10) upper front section. View of cockpit enclosure at top left shows seating arrangement for pilot, co-pilot, avigator, and radio operator, and accessory floor for radio equipment is shown at rear.

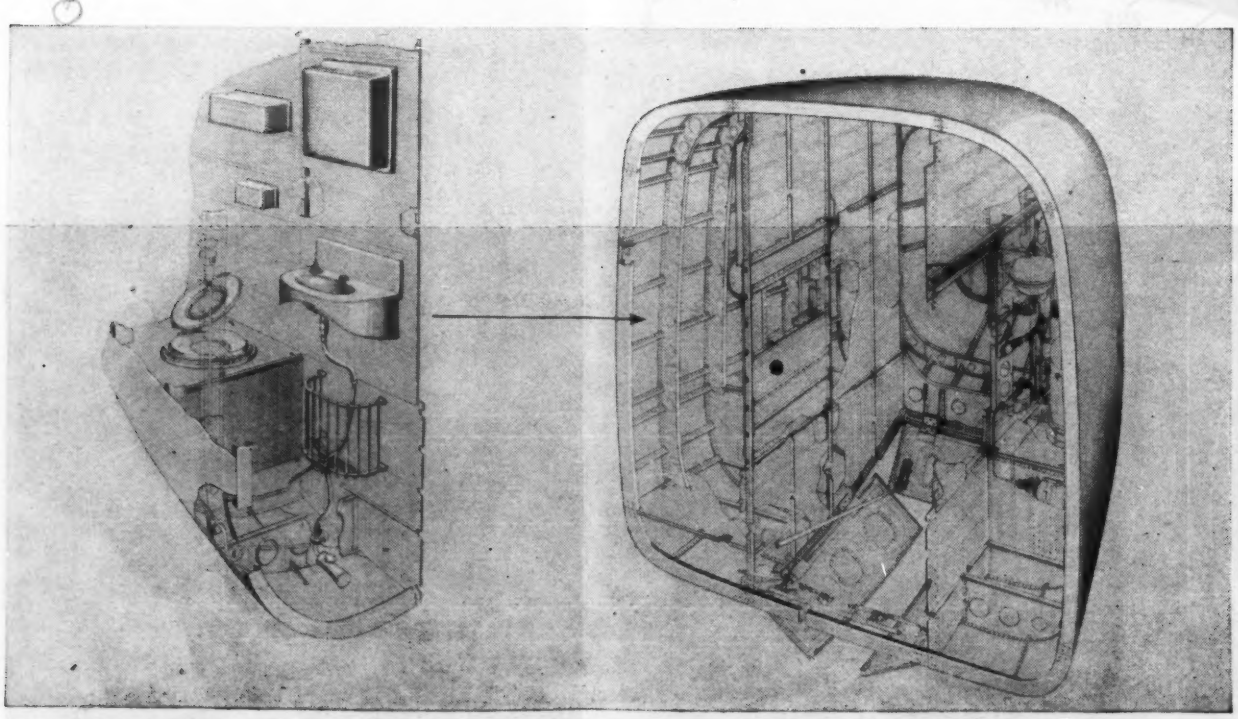




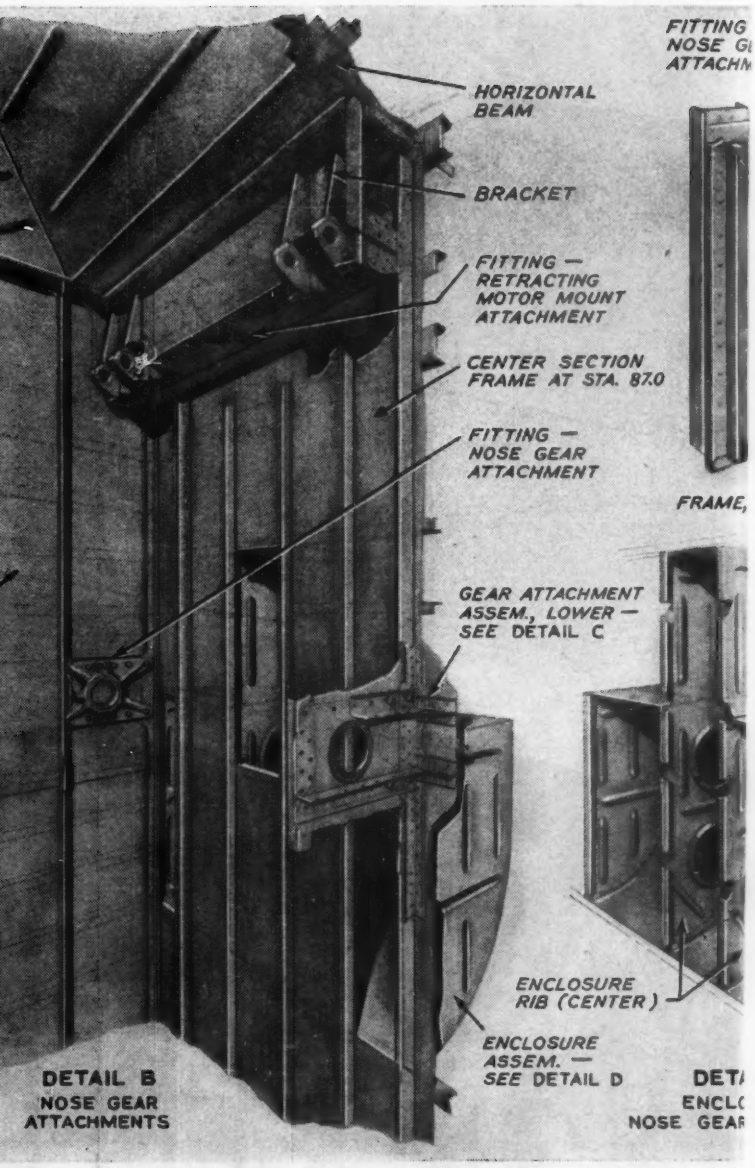
imensions.


STA. 87.0
STA. 104.5
STA. 69.5
HORIZONTAL BEAM
BETW. STA. 69.5 AND 104.5
ENCLOSURE ASSEMBLY — STA. 69.5, NOSE GEAR TRUSS
DETAIL A
NOSE GEAR ATTACHMENT, UPPER
CONTROL COLUMN ENCLOSURE
UPPER SECTION FRAMES
VERTICAL BEAM — STA. 69.5 TO 87.0
BEAM, COCKPIT FLOOR
CENTER BEAM
INTERMEDIATE BEAM
INBOARD BEAM
OUTBOARD BEAM
ENCLOSURE ASSEMBLY — SEE DETAIL A
GEAR ATTACHMENT, UPPER — SEE DETAIL B
GEAR ATTACHMENT — SEE DETAIL C
ENCLOSURE ASSEMBLY, NOSE GEAR MECHANISM — SEE DETAIL D
JACK-POINT ASSEM., MAIN BODY SECTION, STA. 87.0 — SEE DETAIL E
BULKHEAD ASSEM. FUSE. MAIN BODY SECTION — STA. 69.5 TO 87.0
NOSE GEAR ATTACHMENTS AND ENCLOSURES
ASSEMBLY OF MAIN BODY FRAMES, STA. 69.5 TO 104.5
DETA
NOSE
ATTACH

Fuselage installation for housing

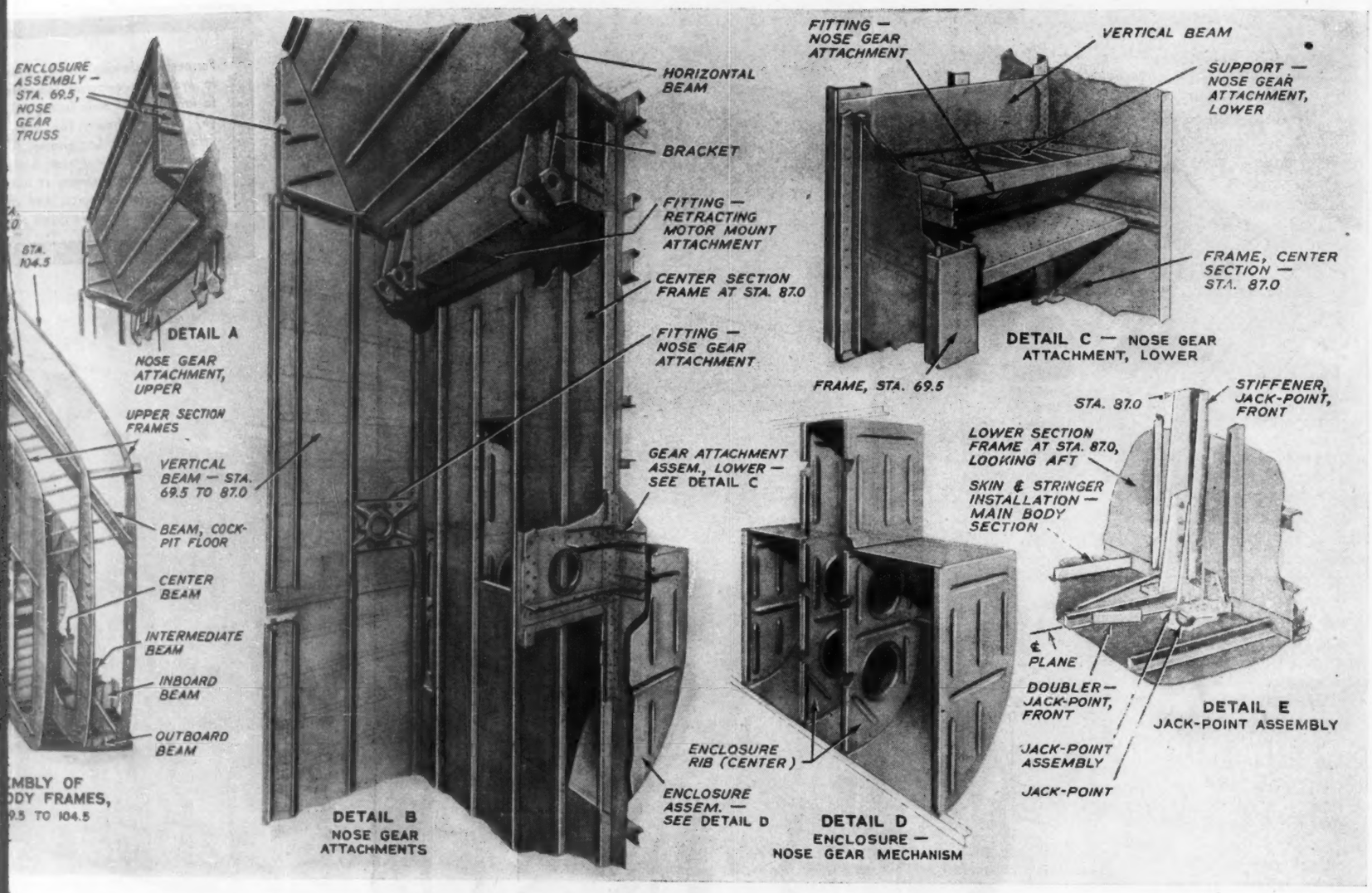


Nose section compartments. Hydraulic equipment is at right, nose gear doors in center, and lavatory at left.

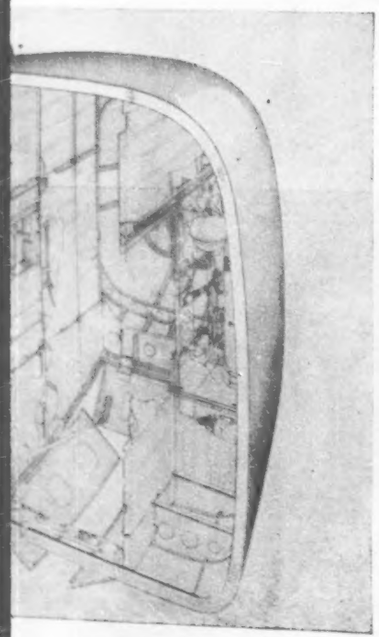


or housing and supporting the nose gear.

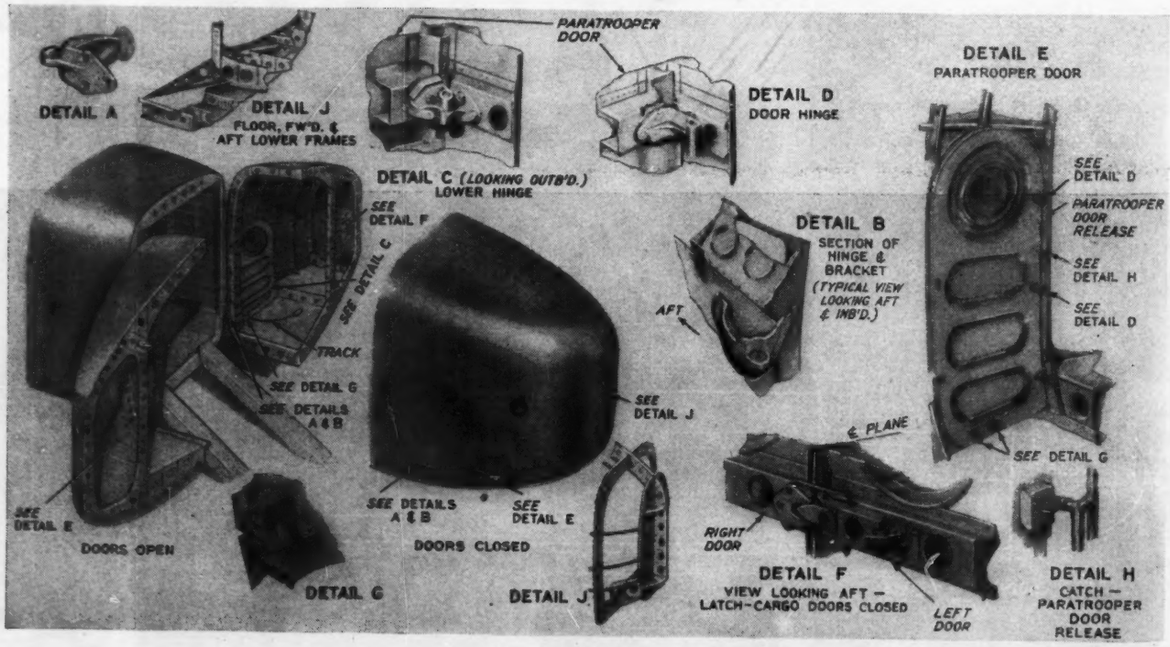
Details of rear



Fuselage installation for housing and supporting the nose gear.



doors in center, and lavatory at left.



Details of rear cargo door installation.

in the web; gage is .032 and depth is 5 in. at a typical section. Arched frames are notched for installation of continuous bulb angle fore-and-aft stringers.

In the top of the upper front section is a cutout for an air scoop which supplies fresh air to a secondary heat exchanger and ducts mounted just below the fuselage contour. The accessory floor of the upper front section is utilized for mounting radio and avigational equipment. At the end of cockpit floor, where the accessory floor commences, the transverse floor beam is 27 in. deep. Upper chord and vertical stiffeners of this member support the accessory floor, and the lower chord members sustain the cockpit floor and its longitudinal beams.

Behind the transverse floor beam are formers with sides tying into the vertical stiffeners and tops secured to the accessory floor longitudinal beams. Formers are rounded at the bottom and notched to permit passing of stringers. A metal cover is riveted to formers and stringers to box the full width of the fuselage. The box beam thus formed serves to stiffen the cross-beam of the frame at the forward end of the accessory floor (station 196½). On the cross-beam are mounted control pulley brackets and engine control bellcranks.

Fuselage Upper Rear Section

Upper rear section extends from the rear center section spar (station 391) to the end of the fuselage at the cargo door hinge point. It is of monocoque construction, embodying main and auxiliary frames, bulb angle longitudinal stringers, and skin.

Because of equipment mounted in this section, main frames are designed as deep web beams, measuring 31 in. at a typical section. The .020 webs have flanged lightening holes, lower chord members are double rolled lip angles riveted on both sides of the web, and upper chords are pressed C-sections or angles conforming to the fuselage contour.

Between the wing rear spar (station 391) and the first main frame (station 409) is a box structure housing and supporting three automatic pilot servo units for operating ailerons, elevator, and rudders. Provision is also made for supporting pulley brackets for the servo emergency disconnect mechanism. On both sides of the servo units, fittings are installed on the rear spar and on the first main frame for supporting two tubes for mounting aileron, elevator, and rudder control sectors.

On the centerline, between first main frame (station 409) and second main frame (station 444), a structure is provided for mounting the flap operating mechanism.

See in open position is half of floor installation above aerial delivery doors. Tracks drop down from ceiling, fit into spaces on each side of middle under-floor section, and guide containers through doors. Also shown are (1) Latch for floor over doors, (2) center beam, removable for aerial delivery, (3) motor-driven actuator for doors, (4) engine-hold-down fitting in center beam, and (5) cargo tie-down fitting. Raised strips (6) are being replaced by corrugation.

Between the second main frame (station 444) and the third main frame (station 479) another box structure houses the self-ejection life raft, and the door of the raft installation also affords an emergency exit for personnel. The box walls and vertical stiffeners also provide support for mounting eight G-1 oxygen bottles and associated tubing.

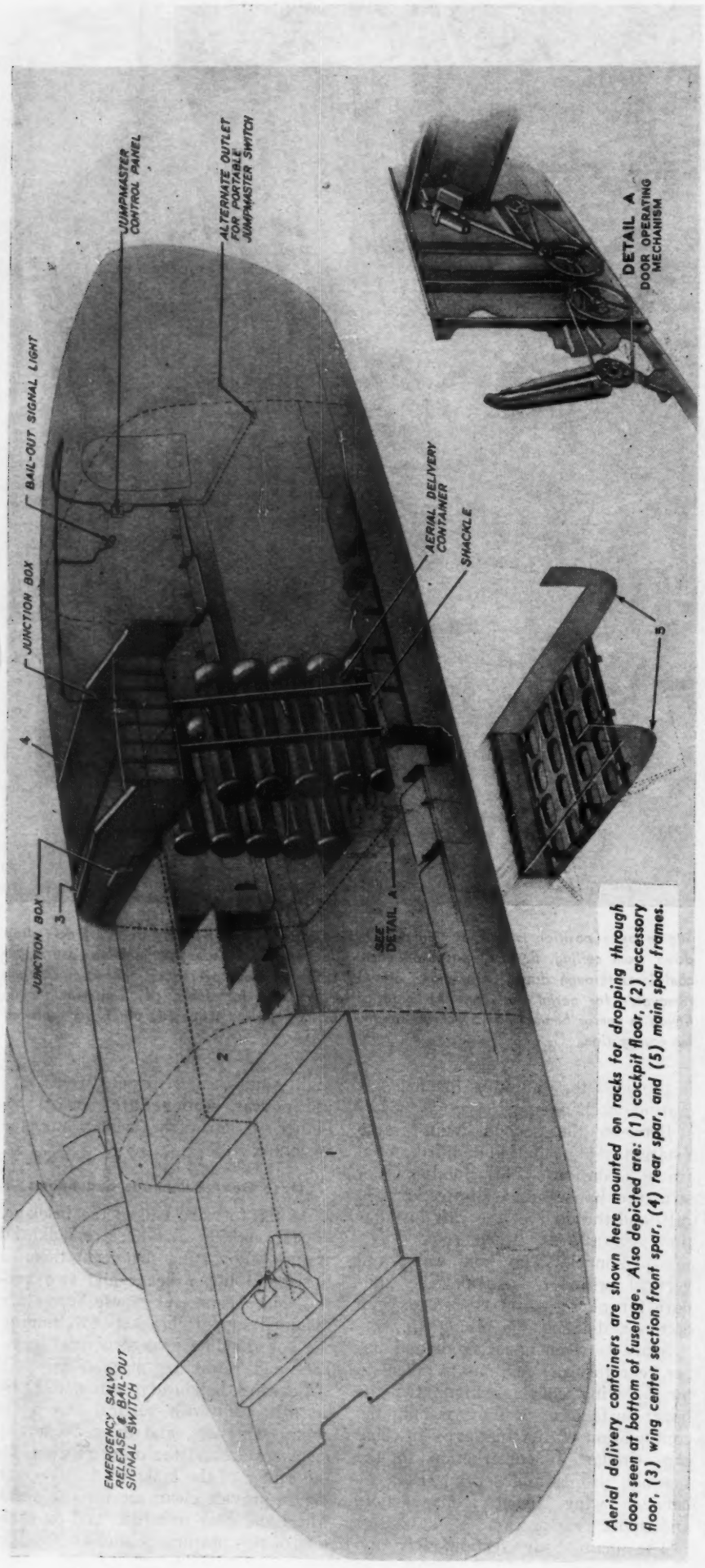
Space between upper front and upper rear fuselage sections is taken up by the wing center section. On the upper surface of the wing is built the continuation of the fuselage—fuselage cap—similar in construction to the fuselage proper and serving as a tie between wing, upper front section, and upper rear section.

The main body section, left and right sides, and upper front and upper rear sections are riveted together to form the center fuselage structure.

Nose Gear Bulkheads and Beams

At the forward end of the fuselage, at stations 69½ and 87, are bulkhead frames supporting between them a horizontal upper beam and two vertical side beams. On these beams are mounted support brackets for hinging the nose landing gear structural members and retracting mechanism.

Forward bulkhead (station 69½) is an .020 web with vertical and horizontal stiffeners, and flanged contour members around the outer portion. In the center of the bulkhead is an opening to provide clearance for the nosewheel and gear structure, and on each side of this opening is another passage



Aerial delivery containers are shown here mounted on racks for dropping through doors seen at bottom of fuselage. Also depicted are: (1) cockpit floor, (2) accessory floor, (3) wing center section front spar, (4) rear spar, and (5) main spar frames.

for access to the nose compartment. At the top of the bulkhead, on each side of the center opening, is a cut-out covered by a pyramidal housing to provide clearance for pilot's and co-pilot's control columns in extreme forward position.

Aft bulkhead (station 87), a combination unit at the lower portion and having a former frame attached at the top, is also provided with openings on each side. Clearance for the nose gear retraction mechanism is provided by three smaller openings covered on the aft face by an enclosure consisting of vertical formers, stringers, and skin fitted with an access door to permit inspection (from cargo compartment) of nose gear units.

The horizontal and vertical beams between bulkheads at stations 69½ and 87 are of conventional web, chord, and web stiffener construction. Horizontal beam has an .020 web and is 35 in. wide. Web of the vertical beam is .064 above the nose gear torque shaft fittings, and .040 below. Secured between the bulkhead frames, the horizontal beam and vertical beams form a rigid structure to absorb loads imposed by the nose gear and transfer them to forward end of fuselage.

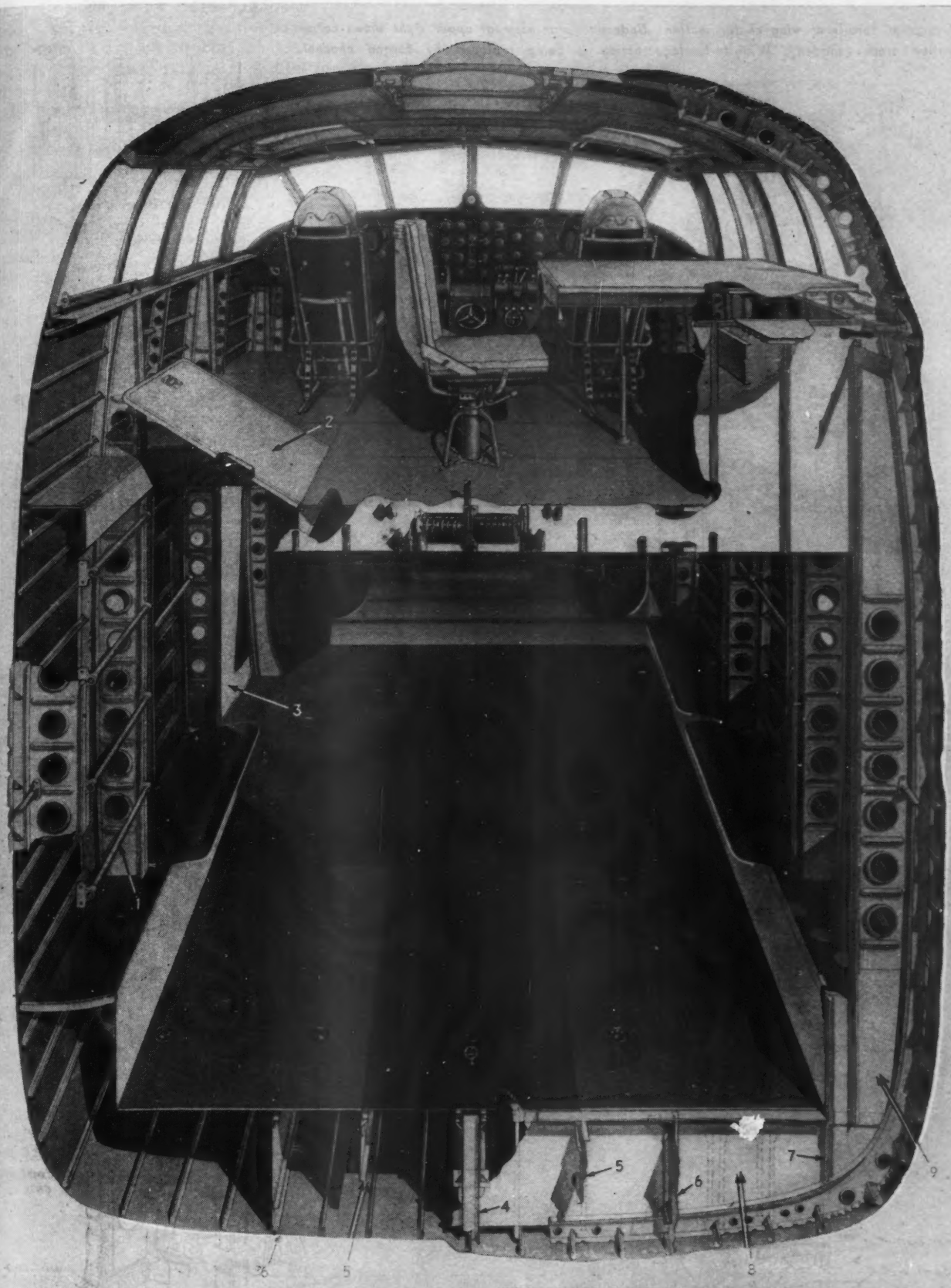
On the inboard sides of the vertical beams, fittings are mounted to support the nose gear lower truss and retraction shaft. Outboard sides of the vertical beams are reinforced in the region of the fittings by two horizontal beams about 10 in. deep which run between the bulkhead frames.

The nose gear upper truss supporting fittings are bolted to an auxiliary box beam formed by adding bulkheads and front and bottom sides at the junction of the horizontal beam and the aft bulkhead frame at station 87. The box beam also contains the support fitting for the upper terminal of the nose gear gravity-drop energy-absorber unit.

At the lower portion of the aft bulkhead and bolted to a vertical channel stiffener, is mounted one of the three major airplane jack-points.

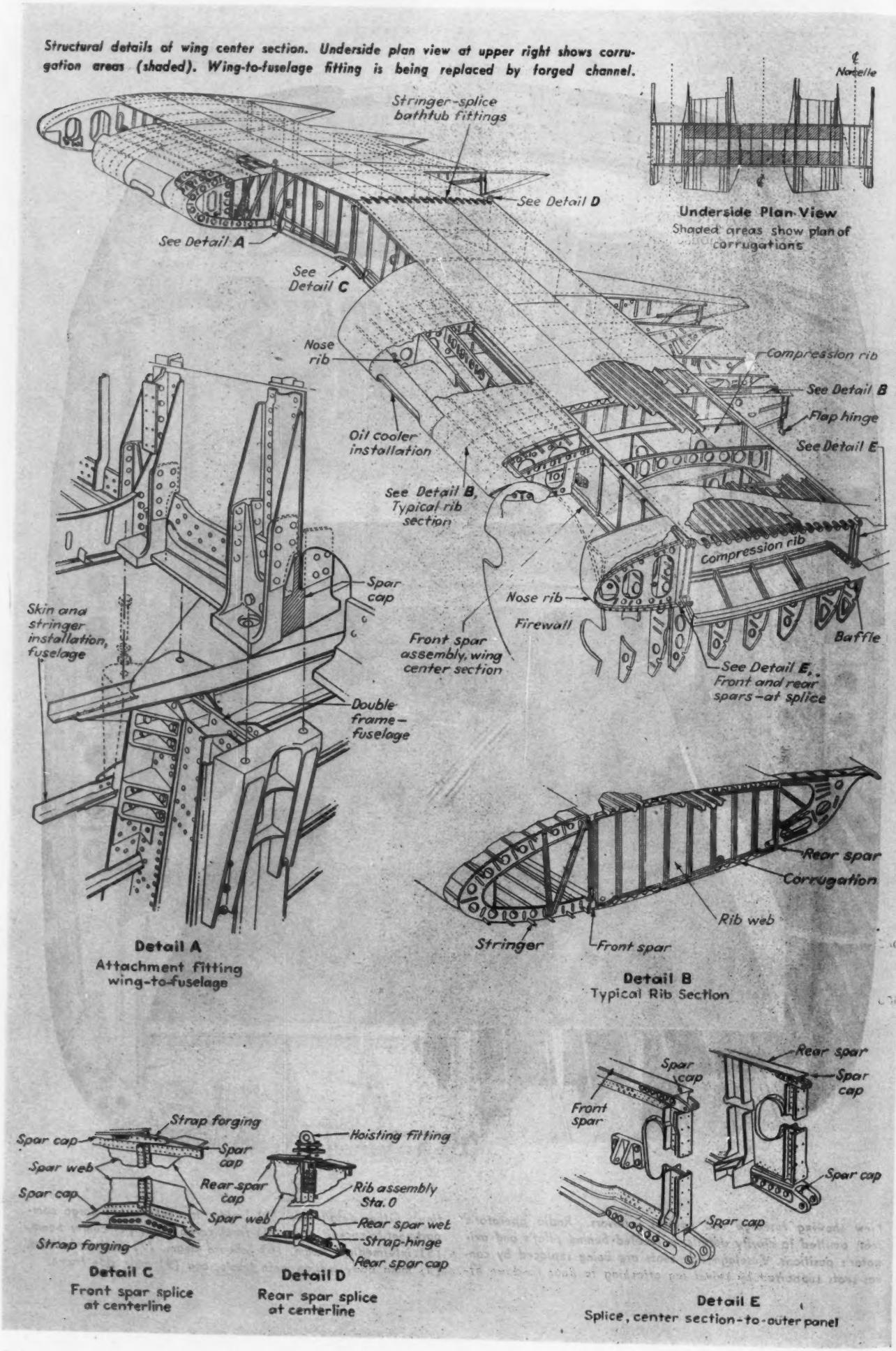
The nose section extends forward from the bulkhead frame at station 69, and is a conventional semi-monocoque structure having pressed C-section frames, stringers, and skin. It is divided into three compartments by two vertical bulkheads which run full height from the frame at station 69 to that at station 17.5.

The center compartment houses the nose gear in retracted position and at the bottom are three doors operated by the gear. The two rear doors are



View showing fuselage and cockpit interiors. Radio operator's seat, omitted to clarify details, is located behind pilot's and avigator's positions. Fuselage side seats are being replaced by canvas seats supported by swivel leg attaching to floor tie-down fitting. Other details are: (1) Ladder to cockpit, (2) cargo compartment-to-cockpit door, (3) front cargo door, (4) center beam, (5) intermediate beam, (6) inboard beam, (7) outboard beam, (8) main body section main frame, and (9) main side frame.

Structural details of wing center section. Underside plan view at upper right shows corrugation areas (shaded). Wing-to-fuselage fitting is being replaced by forged channel.



hinged at the outer edges and the front door is hinged at the forward edge, and all are constructed of double skin, with inner skin formed with depressions.

Left compartment is the lavatory equipped with chemical closet, tissue holder, relief tube, water tank, basin, towel container, and waste paper rack. A circular window affords lighting and visibility.

Right compartment houses hydraulic equipment, and a quick-removable panel in the vertical bulkhead provides ready access for inspection and servicing of nose gear. Entrance to left and right compartments is via openings in the bulkhead at station 69.

The nose section is attached to the fuselage proper by tension bolts through fittings riveted to stringers and mating with similar fittings on the center fuselage structure.

Cargo Doors

Rear portion of fuselage is constructed in the form of two large clam-shell type doors which swing on a vertical hinge line at fuselage sides, and when fully opened, provide a loading area 8 ft. square.

The doors consist of C-shaped frames, stringers, skin, and a vertical frame where the C-frames terminate, and are held in closed position by latches located in the center and rear members of the vertical frame.

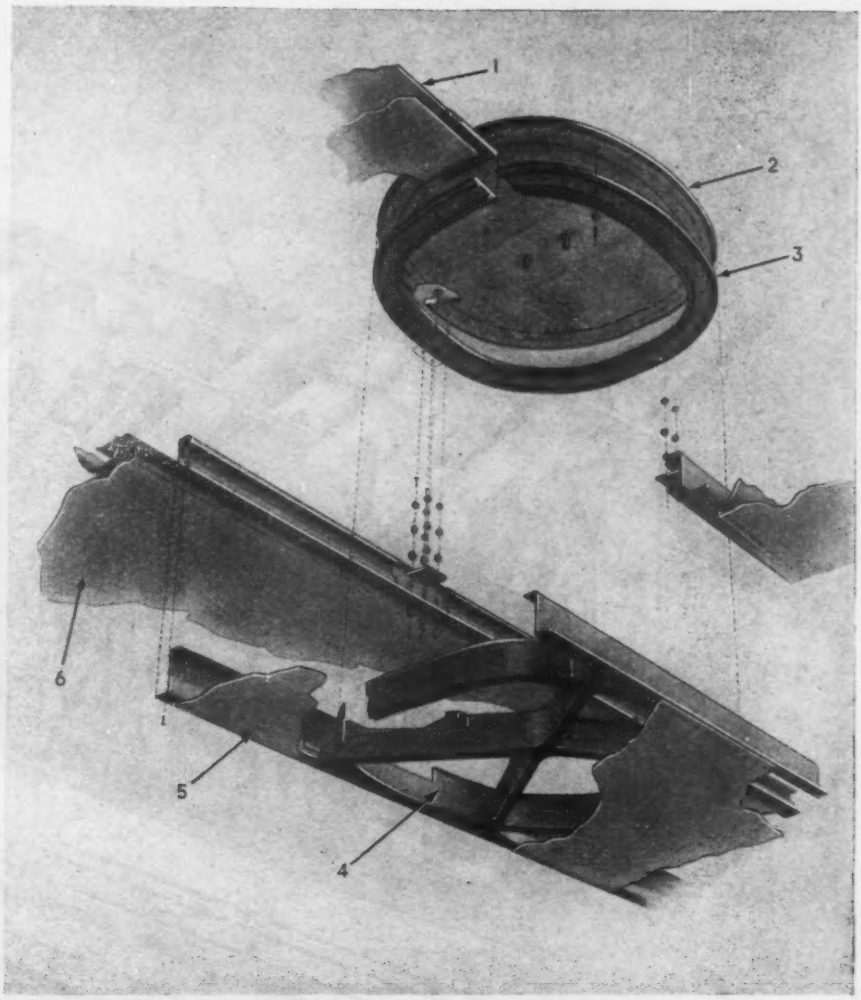
Movement of one door with respect to the other is eliminated by use of four shear pins. Two pins are located at the bottom of the first C-frame and engage two sockets in the fuselage rear frame; the other two are located in the rear of the right hand door and engage sockets in the left hand door.

In each cargo door, two floor sections are provided—rear floor for rear observation and forward floor for paratrooper jumping station. In the side of each cargo door is a smaller door for paratrooper egress. It is of double sheet construction with inner skin recessed in sections to stiffen the outer skin, is hinged at the rear edge, opens inward, and has provision for locking in closed position and hooking in open position.

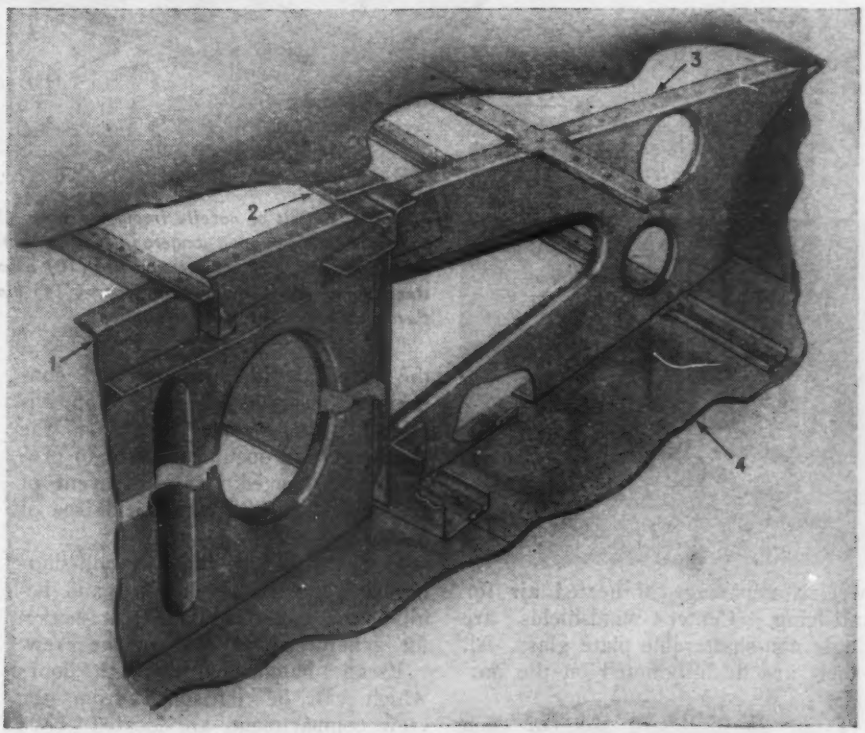
Cockpit Enclosure

Cockpit enclosure, consisting of formers, stringers, and skin, incorporates a windshield, side windows, and top escape hatches.

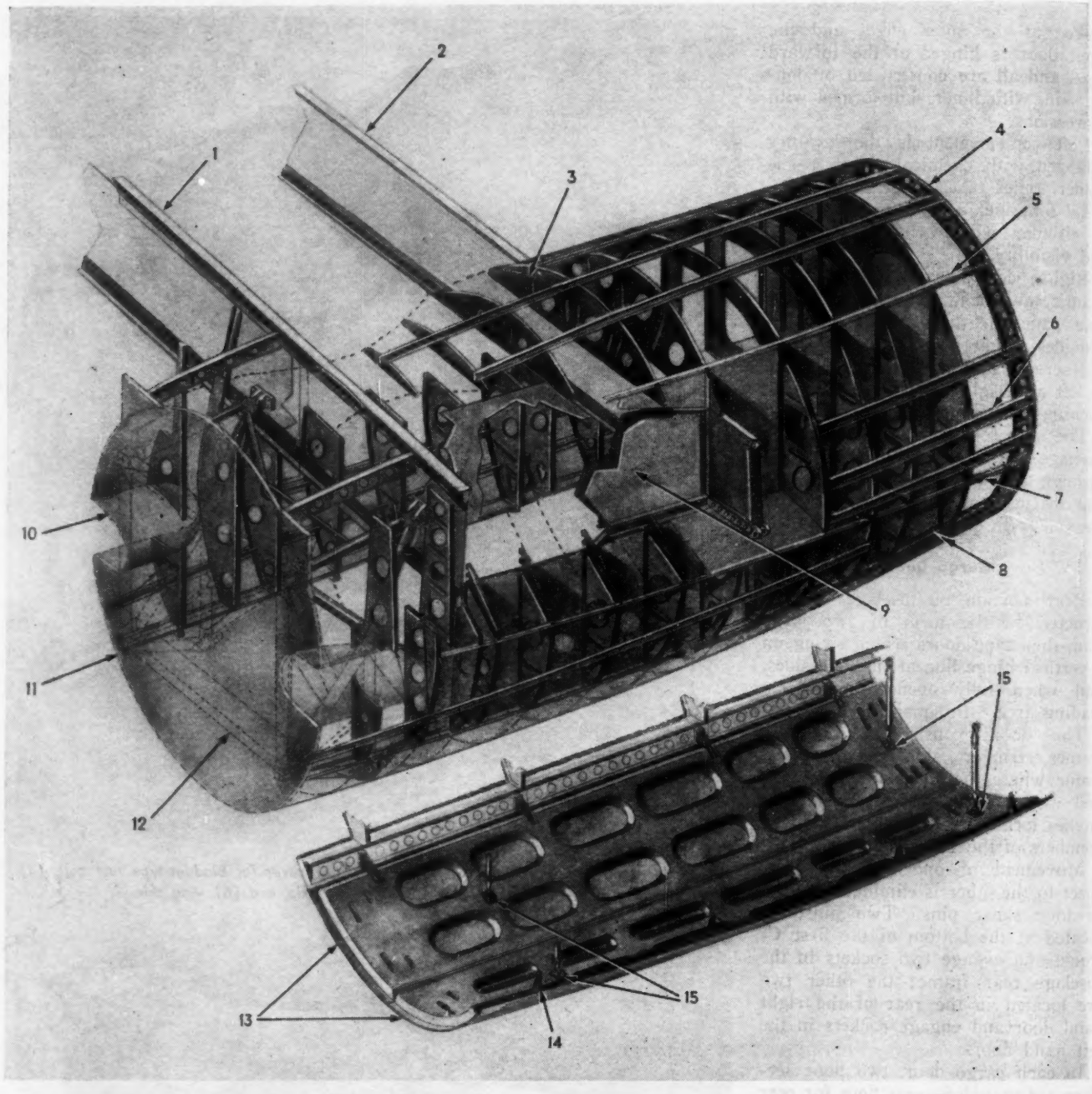
Because of the length of the enclosure span, the sloping V-shaped windshield is divided into four sections. Outer panels located in front of pilot and co-pilot are non-shatterable double plate glass with space be-



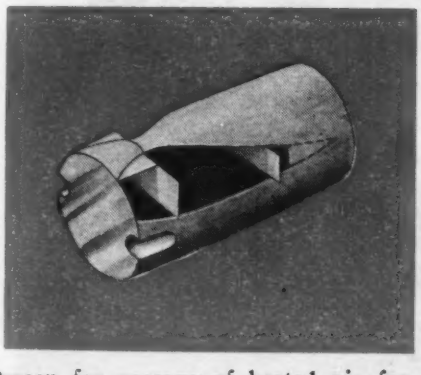
Access door and fuel tank details: (1) Fuel cell, (2) cover for bladder-type fuel cell, (3) cover clamping ring, (4) support channels, (5) door skin, and (6) wing skin.



Details of trailing edge rib and spar connection: (1) Interspar rib, (2) rear spar, (3) trailing edge rib, and (4) access panel to flight controls, extending full length of wing.



Structural details of nacelle frame assembly: (1) Front spar, (2) rear spar, (3) former, (4) end frame, (5) upper longeron, (6) hat-section stringer, (7) intermediate longeron, (8) lower longeron, (9) compression rib, (10) exhaust well, (11) firewall, (12) nacelle structure steel tubing, (13) landing gear doors, (14) hinge, and (15) operating rod bracket. Outline sketch at left shows skin installation.



tween for passage of heated air for anti-icing. Center windshields are single non-shatterable plate glass. All panels are flush-mounted on the outside.

From the outboard side of each outer windshield panel, a curved Plexiglas transition section extends to the forward side window and contains a clear-vision panel approximately 6 in. square, hinged at the rear edge and opening inward to provide unobstructed vision in event of failure to keep the windshield free of ice.

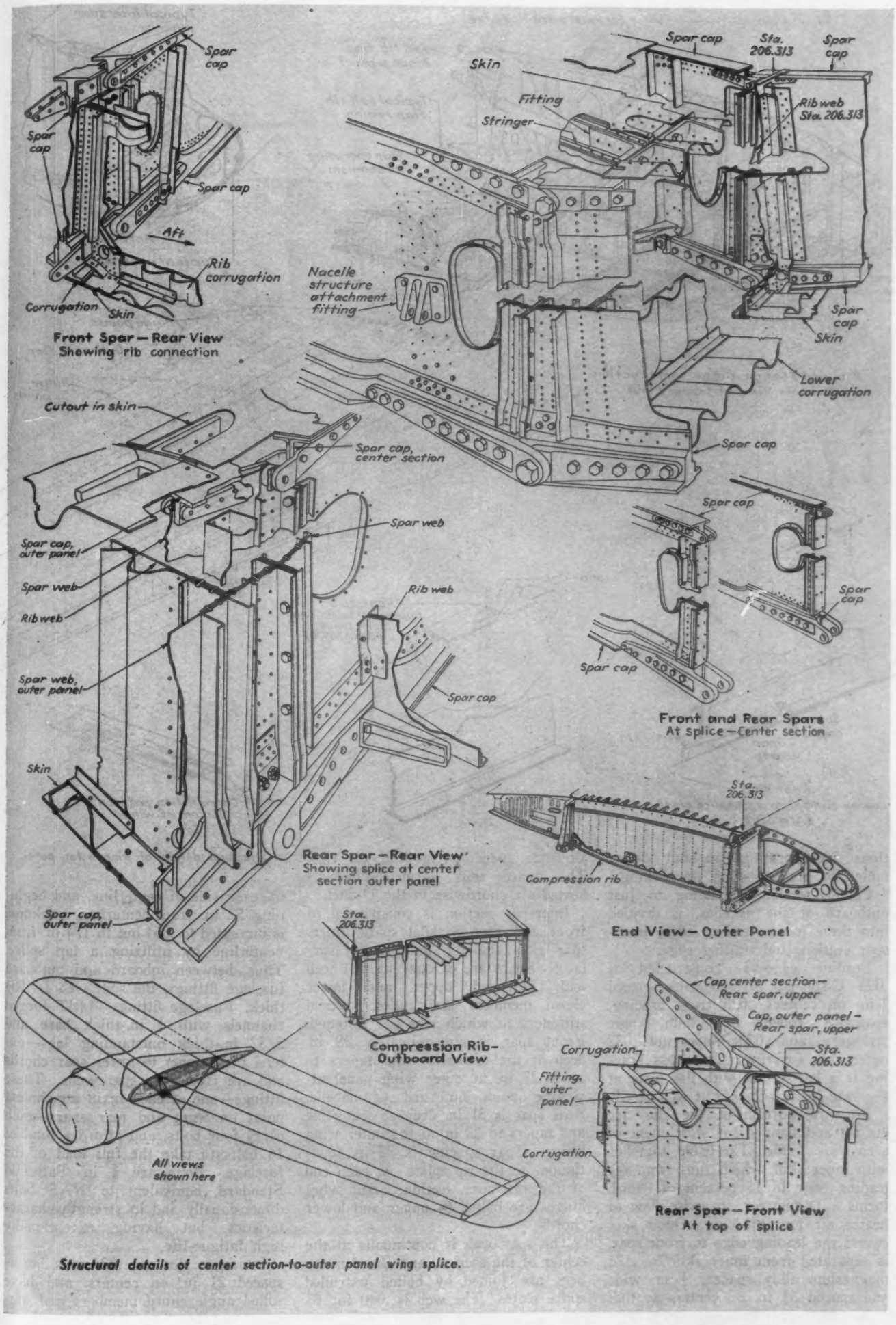
Forward side windows—non-shatterable plate glass—slide aft and behind each is a fixed Plexiglas section for general convenience of the crew.

Escape hatches, fitted with doors which can be jettisoned from the crew compartment, are located above pilot's and co-pilot's seats. Each hatch door consists of a metal frame, Plexiglas panel, quick-release mechanism, and guide wires for sliding a sun shade.

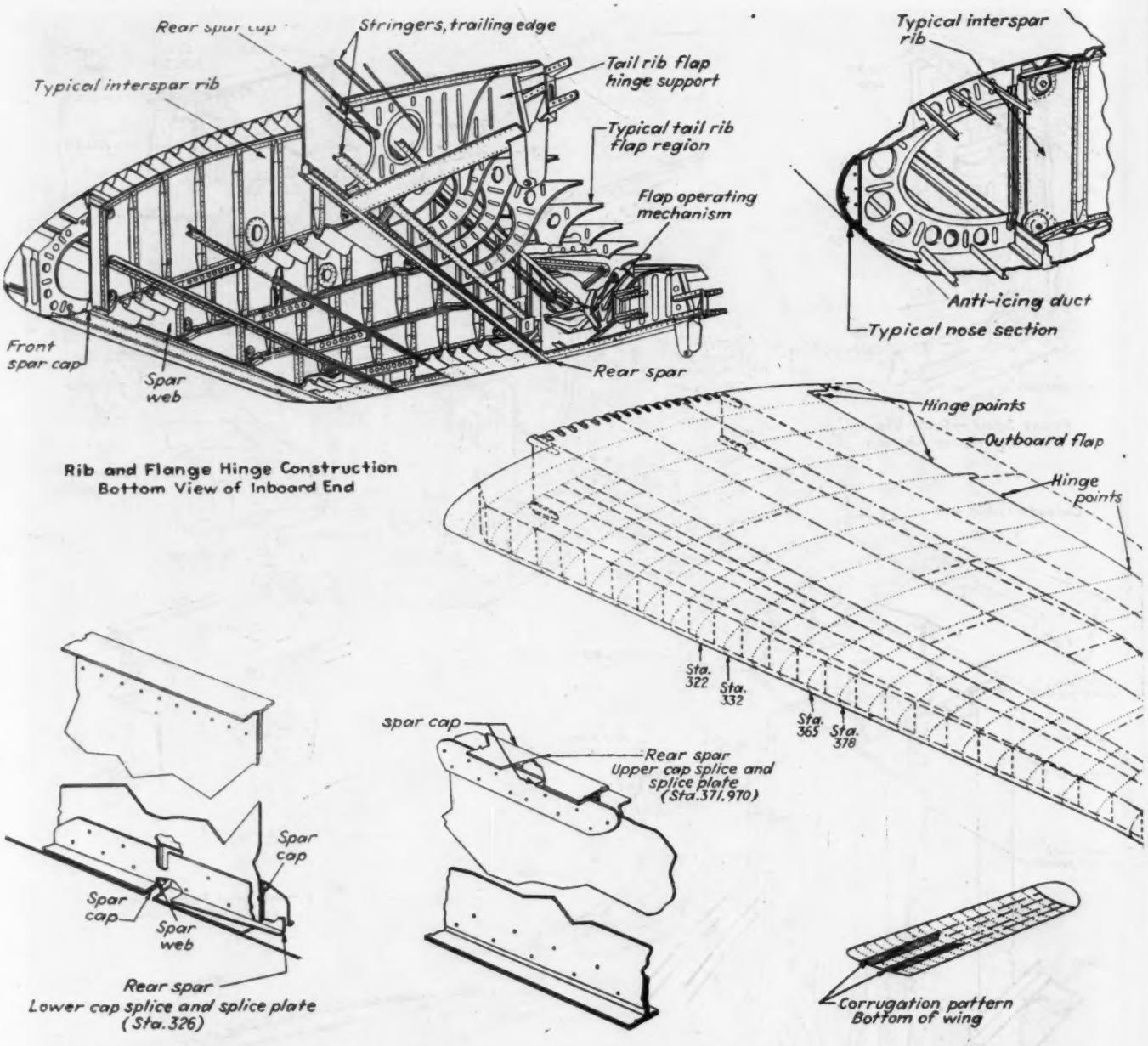
Above avigator's station is an astrodome mounted on a square metal frame door releasable from inside and outside to provide an escape hatch for avigator and radio operator.

Wing Center Section

The Packet has a full cantilever, inverted gull, tapered, all-metal wing consisting of a center section and two outer panels which include an integral anti-icing system. The airfoil combination is based on NACA sec-



Structural details of center section-to-outer panel wing splice.



Rib and Flange Hinge Construction
Bottom View of Inboard End

Structural details of wing outer panel.

tions incorporating washout determined to prevent wing tip stalling.

Center section, extending to just outboard of the nacelles, is divided into three parts—leading edge, interspar section, and trailing edge.

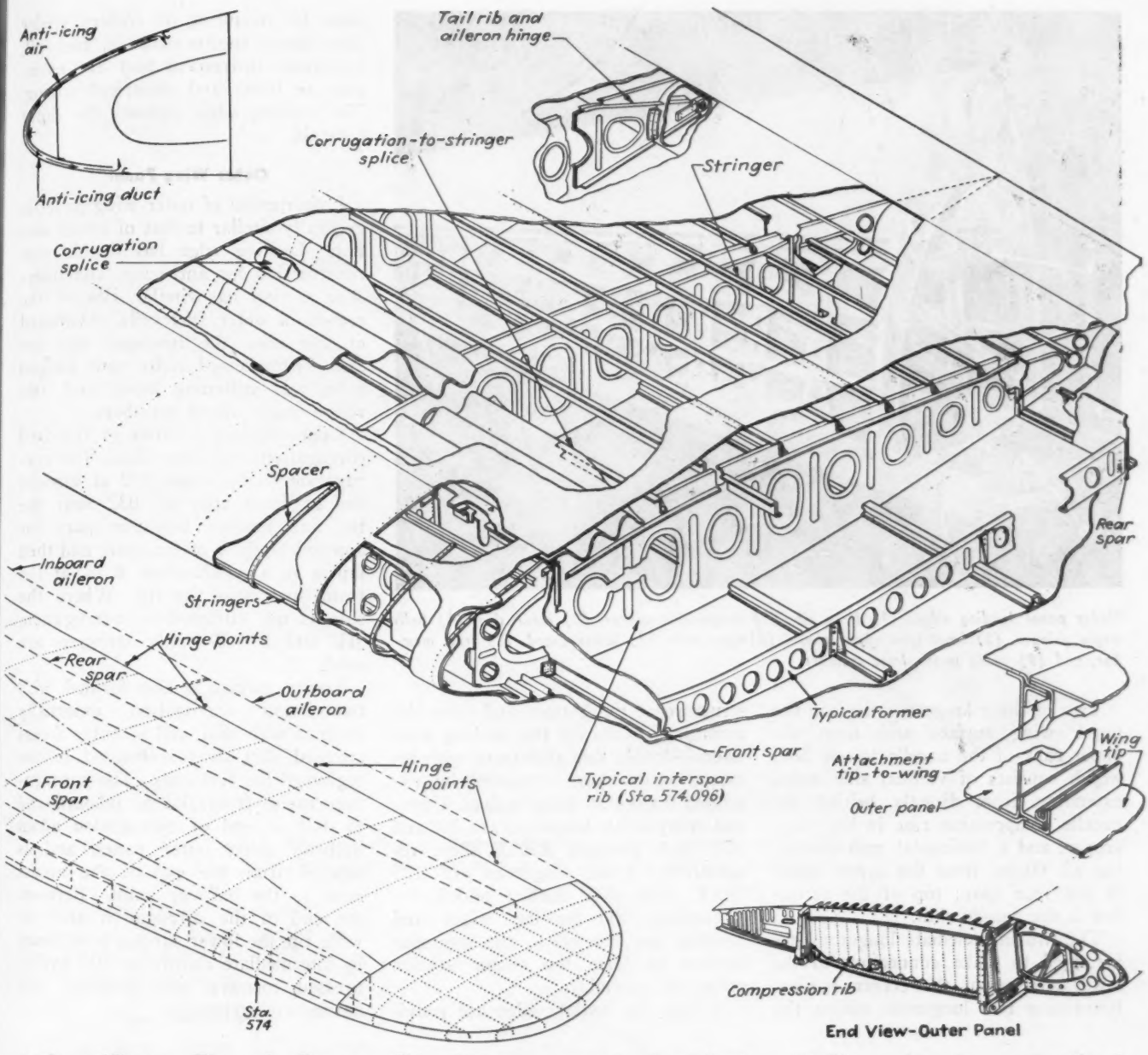
Leading edge is constructed of .025 C-shaped pressed ribs spaced 7-in. on centers, .025 truss bracing, spanwise rolled .025 bulb angle stringers, and .020 inner and .032 outer skin covering. The truss bracing is a hat-section with flat plate at the base for attachment at web of rib.

Forward portion of the ribs are cut off and flanged for attachment of a spanwise baffle. The baffle, together with inner skin, which runs from the leading edge to 15 percent of chord, forms a D-duct for spanwise flow of heated air for anti-icing. Outer skin covers the leading edge to front spar, is separated from inner skin by .125 magnesium alloy spacers ½ in. wide and spaced 3½ in. on centers so that alternate spacer strips fall on ribs. The space thus formed conducts heated air chordwise in the D-duct.

Interspar section is constructed of front and rear parallel spars, interspar ribs, and top and bottom surfaces. Spars are of conventional web with extruded upper and lower chord members and rolled vertical stiffeners to which ribs are fastened. Front spar is approximately 38 in. deep at the centerline and tapers to about 27 in. at outer wing panel attaching point outboard of nacelle. Rear spar is 31 in. deep at centerline and tapers to 22 in. at the outer wing fitting. Spar spacing is 72 in., continuous to the tip splice. At each end of the interspar section, main wing hinges are bolted to upper and lower chords.

The spar web is continuous at the center of the section, and chord members are joined by bolted extruded splice plates. The web is .040 for 63 in. each side of centerline, and beginning 52 in. from centerline, thickness is increased to .064 out to 174 in. from centerline by utilizing a lap splice. Thus, between inboard and outboard fuselage fittings, the spar web is .104 thick. Fuselage fittings—14ST forged channels with ¼ in.-thick base and 5/32 in.-thick outstanding legs—extend from upper to lower spar chords and are riveted to spar webs. These fittings—one at each main attachment point on front and rear spars—each carry four bolts, and afford a total of 16 bolts to take the full load of the fuselage. Bolts are ⅜ in. Fairchild Standard, equivalent to NAS bolts dimensionally and in strength characteristics, but having exceptionally high fatigue-life.

Interspar ribs are .025 web beams spaced 21 in. on centers, and have rolled angle chord members and hat-



End View-Outer Panel

section stiffeners. The web ribs are utilized to form side supporting members for the bladder type fuel cells carried in the center section, and provision is made in the ribs to accommodate fuel cell interconnecting fittings.

In the nacelle are two compression ribs spaced approximately 44 in. to permit housing of landing gear. The ribs are double web box beams with .051 webs spaced by .064 channel members, and .072 channel chord members on the webs are decked by .064 plate. Forged and cast fittings are internally mounted on the compression ribs to accommodate anchor points for the nacelle steel structure and landing gear structure.

Top surface of interspar section is constructed of spanwise trapezoidal hat-section stiffeners and heavy gage outer skin. Stiffeners are 75ST varying from .125 to .040 from front to rear spar, and at centerline are spliced with bathtub fittings and tension bolts. Skin between spars is lap-spliced 24SRT (heat-aged to afford high strength), with gage varying from .102 at front spar to .064 at rear spar. Brazier head rivets are used between spars, and from front spar forward, riveting is flush.

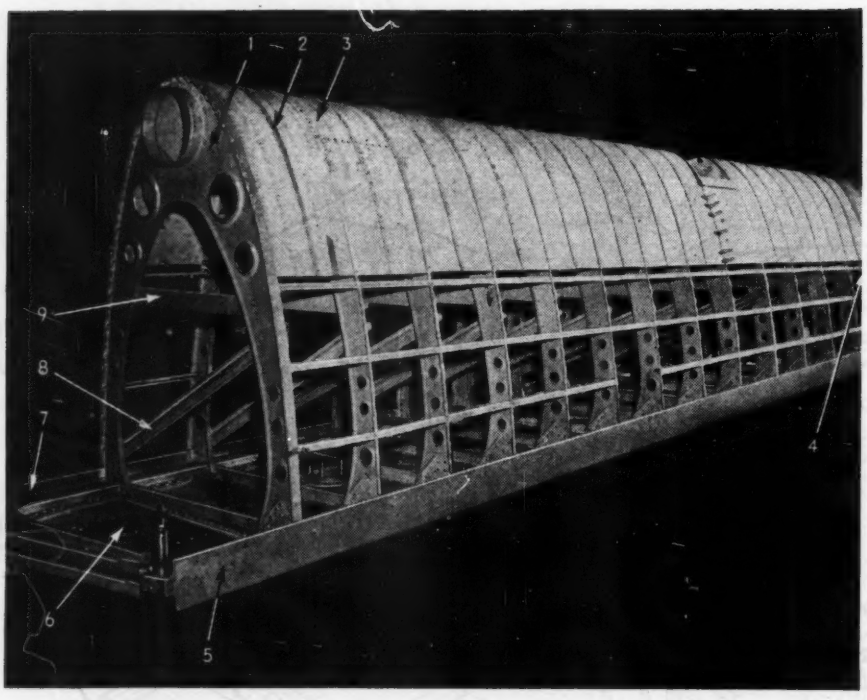
Lower surface of interspar section is made up of standard corrugation and outer skin. The surface is divided into two parts—front and rear—with the corrugation extending aft from front spar about 24 in. and forward from rear spar about 28 in. Between the corrugations, a stressed skin access door provides means for riveting the assembly and installing fuel cells. The corrugated sections and stressed skin access door extend from the centerline to the nacelle inboard compression rib—147 in.

Front spar, rear spar, interspar ribs, compression ribs, and top and lower surfaces are riveted together to form the interspar section.

Trailing edge has conventional pressed ribs and stiffened skin. Special ribs for supporting the flap hinges are constructed as box beams having pressed webs, rolled section chord members, and stiffeners between webs. At the ends of these ribs and between the webs, cast flap hinge fittings are bolted.

Nacelle Frame Assembly

When installed, the nacelle frame assembly becomes an integral unit with the center section, and extends, essentially, from aft of the firewall to just beyond the trailing edge of the wing where the forward boom connection is made. It houses the landing gear in retracted position, provides the necessary load-carrying members to transfer the tail load to the wing, and consists primarily of stressed skin, skin formers or frames, longitudinal hat-sections, and six longerons.



Outer panel leading edge: (1) Nose rib, (2) magnesium spacer, (3) inner skin, (4) bulb angle stringer, (5) front spar upper chord, (6) spar web, (7) lower chord, (8) truss member, and (9) plate under truss member.

Two of these longerons tie into the upper wing surface and form the upper caps of the nacelle torque box, which consists of vertical side webs, extending from directly behind the nacelle compression ribs in the wing proper, and a horizontal web extending aft 60 in. from the lower chord of the rear spar; top of the torque box is the nacelle skin.

The two intermediate longerons are arranged to make connection to the lower surface of the center section. Remaining two longerons stiffen the structure at the bottom and form the mounting points for the landing gear doors—double skin structures with recessed inner skin, reinforced by extruded frames at hinge points. Upper and intermediate longerons are .102 and .072 high strength R301T alloy, respectively; lower longerons are .125 24ST, with .072 doubler added.

Leading and trailing edges and nacelles are riveted to the interspar section to form the center section structural assembly.

Within the leading edge are provisions for mounting oil coolers, cooler inlet ducts, engine controls, fuel, oil, hydraulic, instrument and fire extinguisher lines, and electrical wiring. The trailing edge encloses the flight controls.

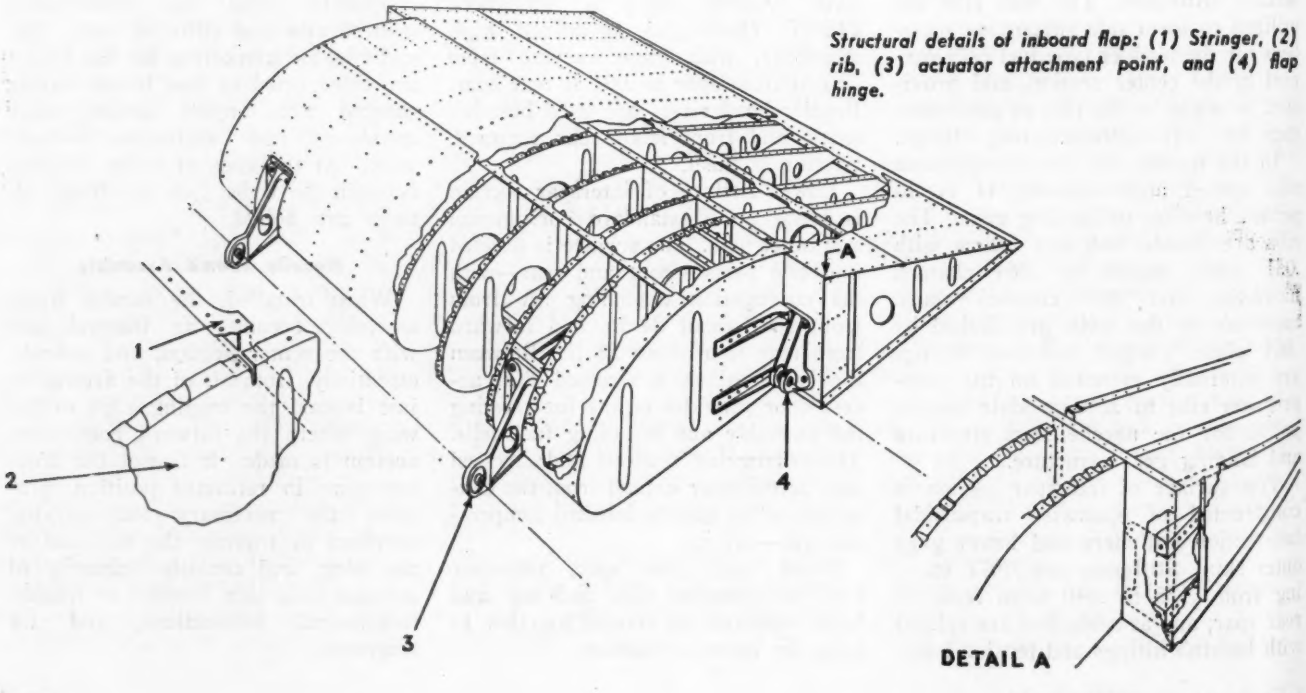
Outer Wing Panel

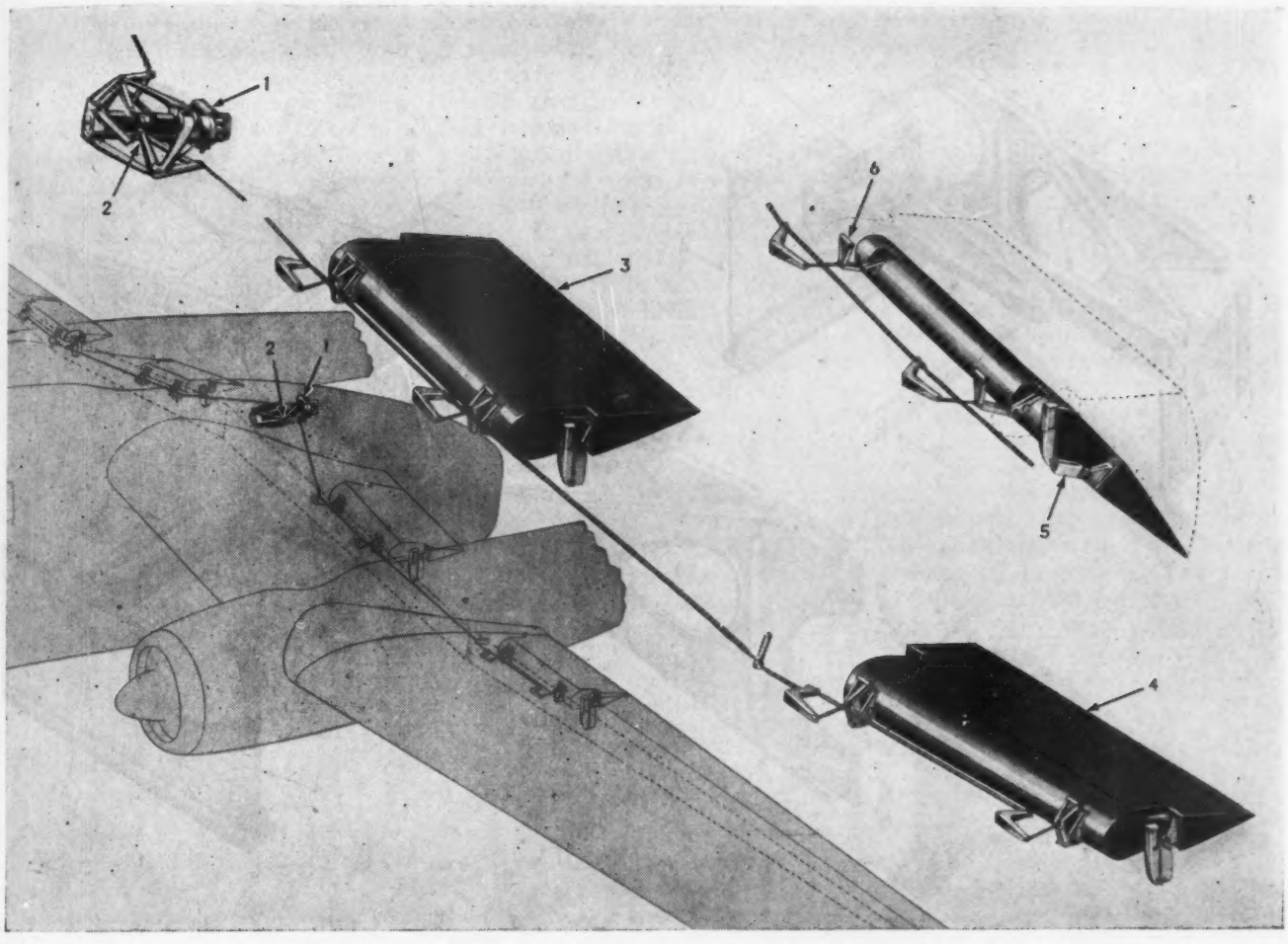
Construction of outer wing panel is generally similar to that of center section. Leading edge has double skin construction for anti-icing, and interspar section has similar ribs in the region of outer fuel cells. Outboard of this area, the interspar ribs are .025 hydropressed webs with flanged holes and stiffening beads and .064 rolled angle chord members.

Upper surface consists of standard corrugation and outer skin. The corrugation varies from .102 at inboard end at front spar to .032 near the tip, and extends between spars for approximately $\frac{3}{5}$ of the span, and then tapers to a width about 8 in. at the front spar near the tip. Where the skin is not stiffened by corrugation, .032 and .040 Z-section stringers are used.

Lower surface is also formed with two-section corrugation externally covered with skin, and a center access stressed skin door is located in the region of the fuel cells. The corrugation varies from .051 at inboard end to .025 at end of corrugation about halfway along outer panel, and is tapered from the end of the access door to the halfway point. Between the end of the corrugation and the wing tip, the lower surface is stiffened by intermediate chordwise .025 hydropressed formers and spanwise .032 hat-section stringers.

Structural details of inboard flap: (1) Stringer, (2) rib, (3) actuator attachment point, and (4) flap hinge.



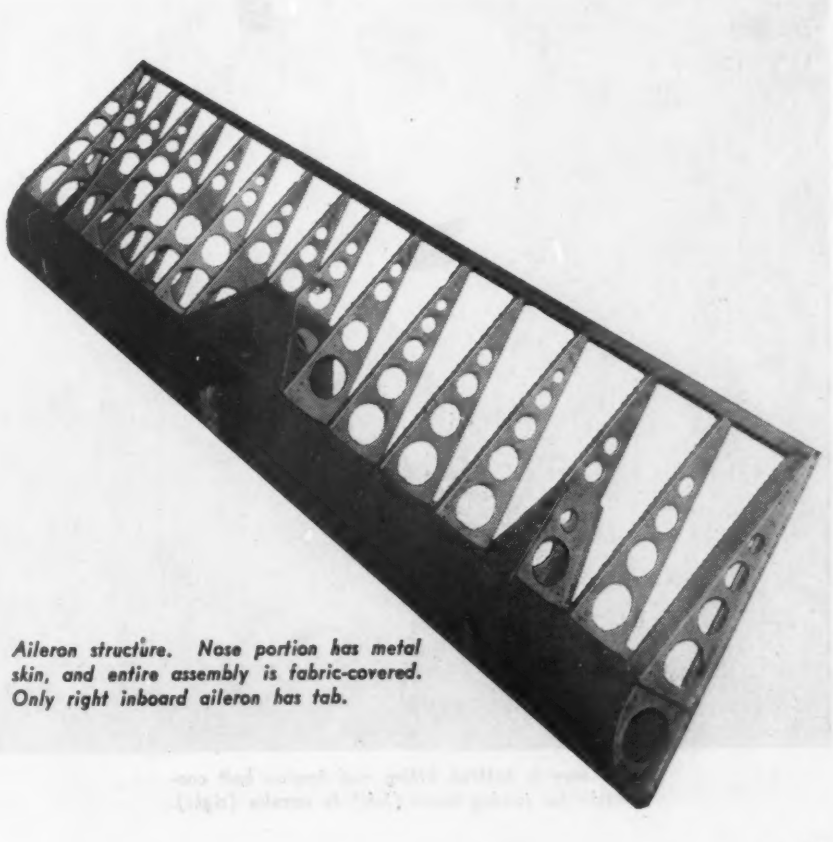


Flap operating mechanism: (1) Motor, (2) screw-and-nut actuator, (3) inboard flap, (4) outboard flap, (5) hinge link, and (6) acutating lever.

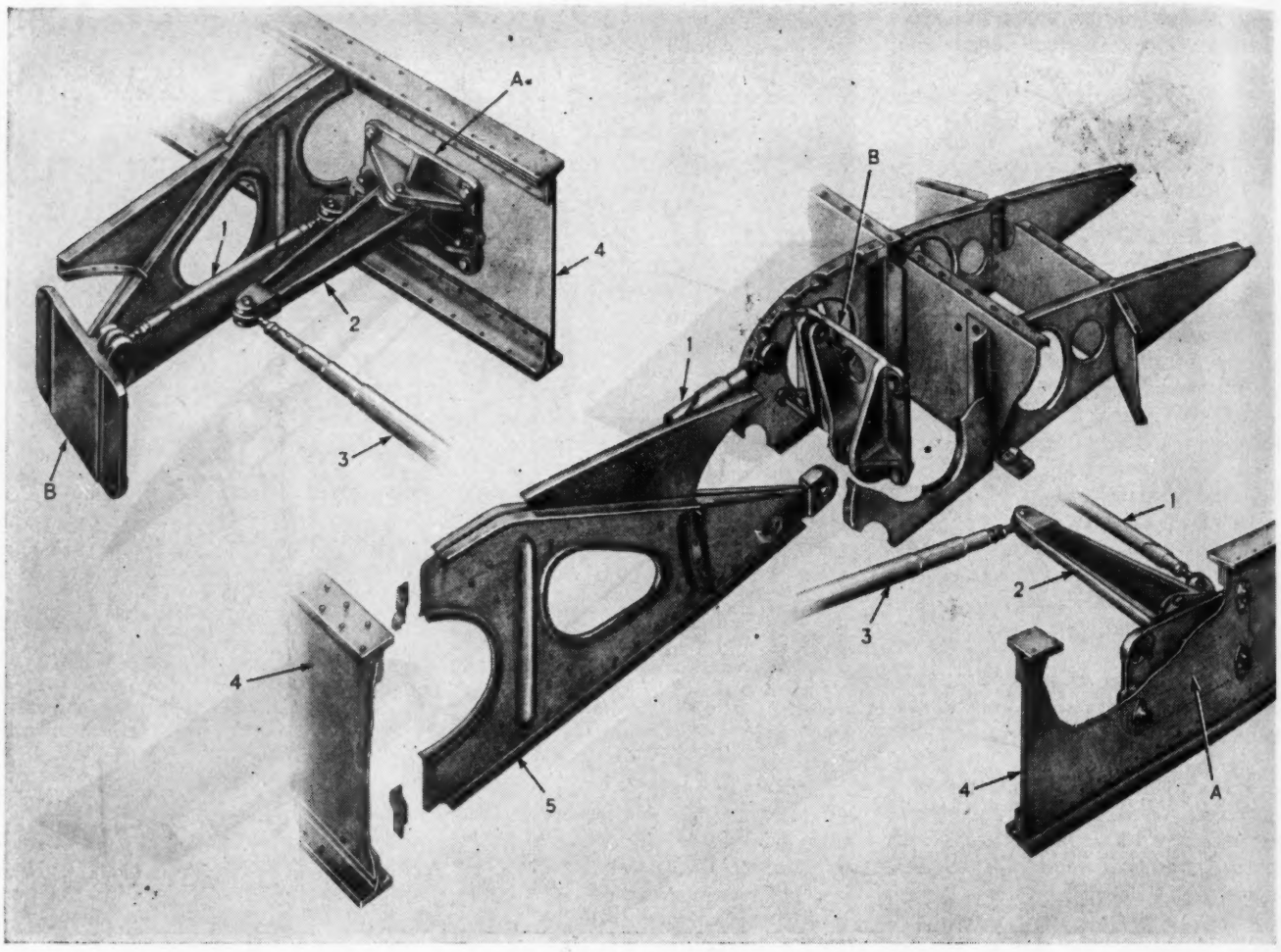
The wing tip is constructed as a separate unit, is bolted to the outer panel, and is formed with .020 pressed ribs and channel stringers.

Flaps and Ailerons

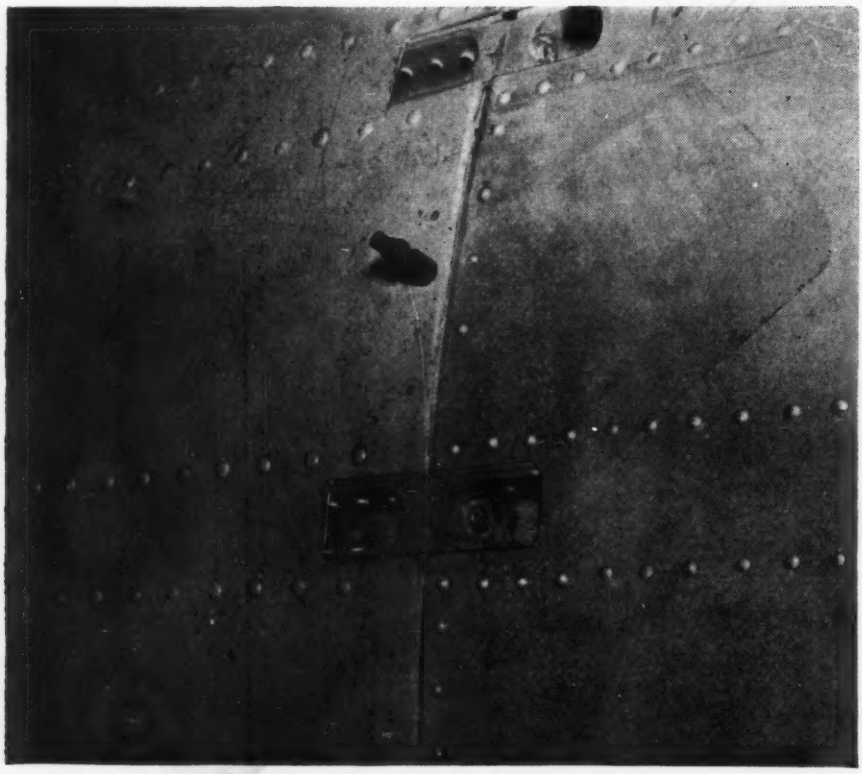
Wing flaps extend for approximately 25 percent of chord, are NACA slotted type, and are constructed of pressed ribs and spars, the latter together with the leading edge skin forming the main structural element. Inboard flaps are approximately 5 ft. 10 in. long and outboard flaps about 7 ft. 8 in. Each flap is attached to the wing by two hinge points at the end of the spar and two actuating points on the leading edge. Connection is made with ball bearing links arranged so that flap motion is, first, almost horizontal, then continuing aft with little angular deflection. As flap motion continues, angular travel increases rapidly to a maximum deflection of 40 deg. Operation is by an electric motor, located in the fuselage, aft of the rear spar, through the medium of a screw-and-nut type actuator connected to the flaps by a system of bellcranks and rods. In emergency, flaps can be lowered by a handcrank.



Aileron structure. Nose portion has metal skin, and entire assembly is fabric-covered. Only right inboard aileron has tab.



Details of aileron hinge and brackets: (1) Operating rod, (2) differential bell-crank, (3) spanwise push-pull rod, (4) rear spar, and (5) outboard aileron hinge rib.



Seen here is bathtub fitting and tension bolt connection for joining boom (left) to nacelle (right).

The aileron installation consists of an inboard and outboard unit, the former measuring approximately 13 ft. 7 in. and the latter 11 ft. 4 in. They have pressed channel spars, pressed ribs, and metal skin to form the main structure, and pressed tail ribs. The entire assembly is fabric covered. Inboard and outboard ailerons operate as a single unit, and the inboard aileron is also fitted with a droop actuator to lower it with the flaps when the latter are in landing position. This provides additional effective flap area, and still permits full operation of the ailerons as such.

Booms and Empennage

Constructed in two sections—forward and aft—the boom assembly is approximately 440 in. long, supports the tail structure, and houses surface controls and tail anti-icing ducts.

Forward boom extends 334 in. from aft of the nacelle and is of semi-monocoque construction utilizing skin, light hydropressed channel section frames fabricated in halves, and longitudinal bending members. For first 100 in. from forward end, the

channel frames (four—exclusive of mating frame) are doubled to form composite units back-to-back. Longitudinal bending members are 75ST hat-sections varying from .025 to .064, with heavy gages on top and bottom because of gust and tow loads. There are twice as many longitudinal members starting at forward end as those ending at aft end (20 forward and 10 aft, with 10 terminating between).

Splice between nacelle frame and forward boom, and between forward and aft booms is of the bolted tension type employing forgings riveted to the stringers; a riveted skin splice makes the joint semi-permanent.

Aft boom picks up vertical and horizontal tail loads, provides shelves to mount control pulleys, and affords sufficient side bending and torsional stiffness for glider tow fittings at extreme end. These features are accomplished by employing heavy bulkheads, longitudinal members, and stressed skin.

Forward two fitting-supporting bulkheads each consists of back-to-back members having .040 webs and .064 flanges. Between webs is a ½-in. plate for supporting the main stabilizer and stabilizer tips. Bathtub type tension fittings mounted in channels take upper and lower fin loads.

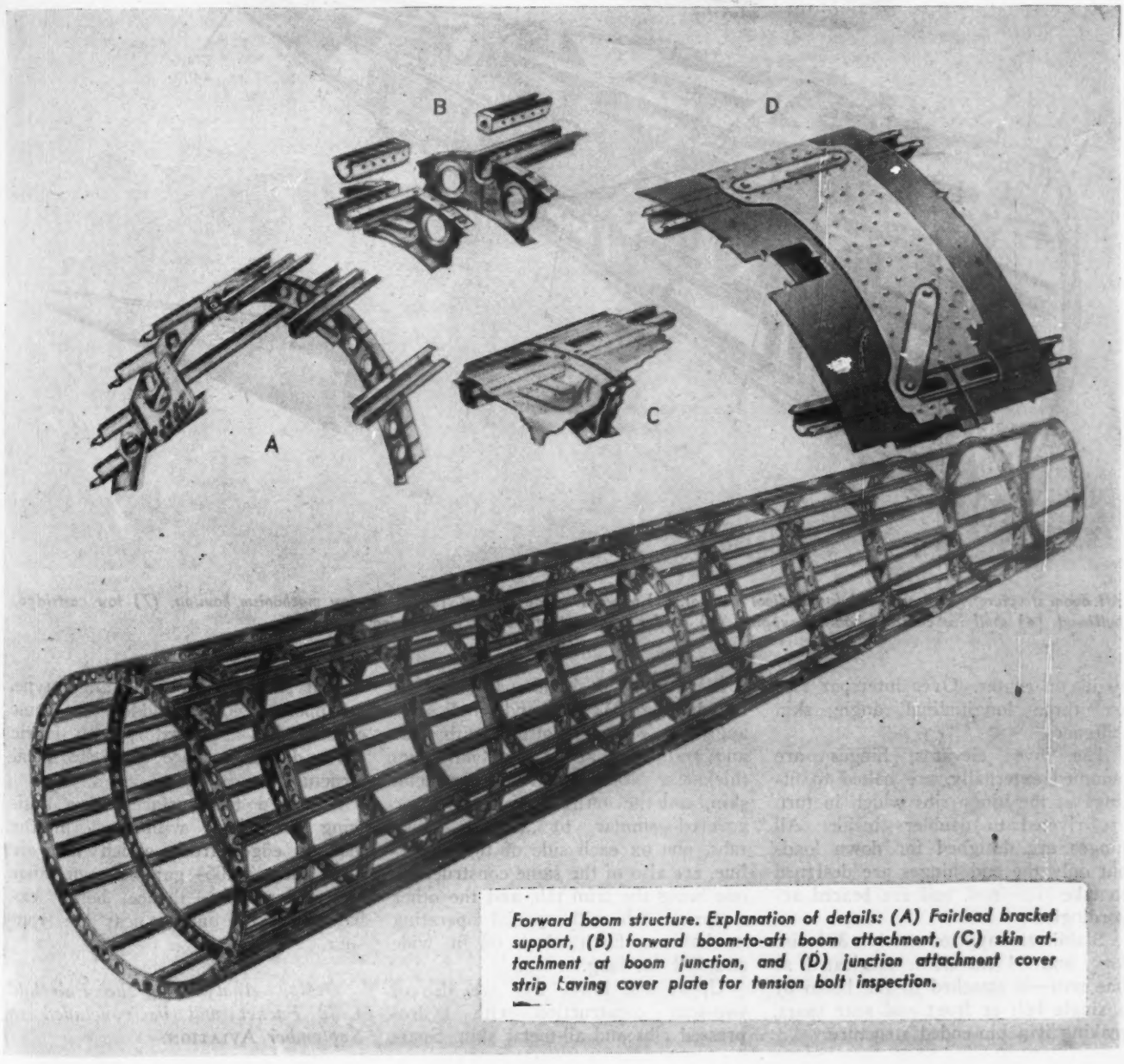
Remainder of the frames in the tail cone support the rudder torque tube and glider tow release mechanism.

Between first two bulkheads are an upper and a lower shelf, each consisting of a web and angle caps, forming two horizontal beams to provide strength for side bending. The shelves are spaced sufficiently to provide ample service accessibility for control quadrants supported between them.

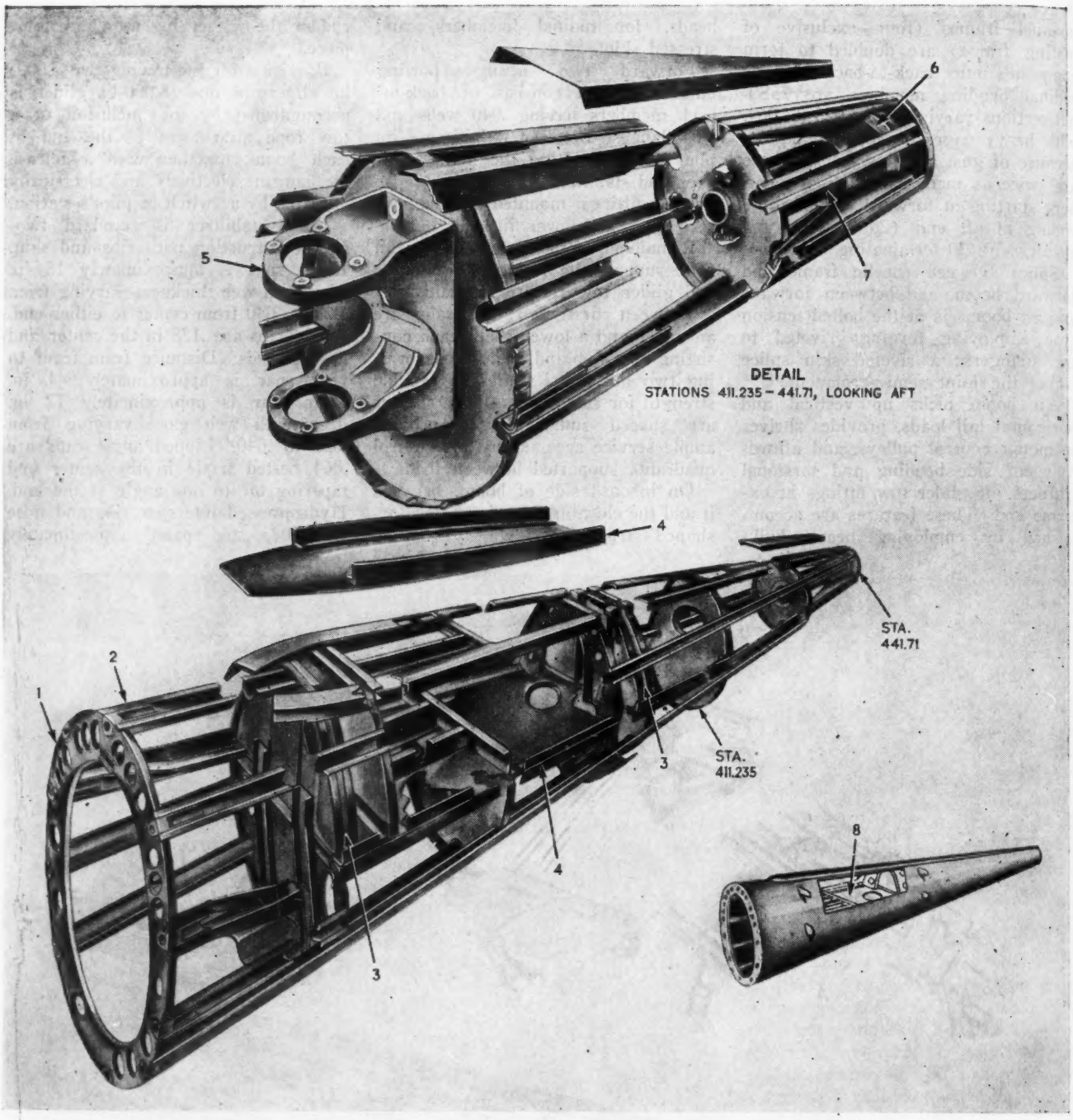
On inboard side of boom, between it and the elevator, is a fixed elevator-shaped structure of width equal to rudder throw, serving as a clearance piece.

Provision for the towing two 7,000-lb. gliders or one 18,000-lb. glider is accomplished by the inclusion of a tow rope attachment at the end of each boom, together with a release mechanism selectively and electrically operated by a switch at pilot's station.

Main stabilizer is standard two-spar construction with ribs and skin. Front spar is approximately 15 in. deep with web thickness varying from .025 to .040 from center to either end. Angle caps are .128 in the center and .064 at ends. Distance from front to rear spar is approximately 41 in. Rear spar is approximately 12 in. deep with web gage varying from .025 to .040. Lipped angle caps are .064 nested triple in the center and tapering off to one angle at the end. Hydropressed interspar ribs and nose ribs, .025, are spaced approximately



Forward boom structure. Explanation of details: (A) Fairlead bracket support, (B) forward boom-to-aft boom attachment, (C) skin attachment at boom junction, and (D) junction attachment cover strip having cover plate for tension bolt inspection.



Aft boom structure: (1) Frame, (2) longitudinal member, (3) forward bulkhead, (4) shelf for control quadrant support, (5) rudder torque tube bracket, (6) glider tow mechanism housing, (7) tow cartridge, and (8) access opening to controls.

10 in. on center. Over interspar ribs are three longitudinal angle skin stiffeners.

The five elevator hinges are mounted externally, are bolted to fittings at the hinge ribs which in turn are riveted to doublers inside. All hinges are designed for down loads but only the end hinges are designed to take side load, and are braced accordingly.

Stabilizer—approximately 304 in. long and 64 in. wide, fabricated as one unit—is attached to the boom by a single bolt at front and rear spars, making it a pin-ended structure.

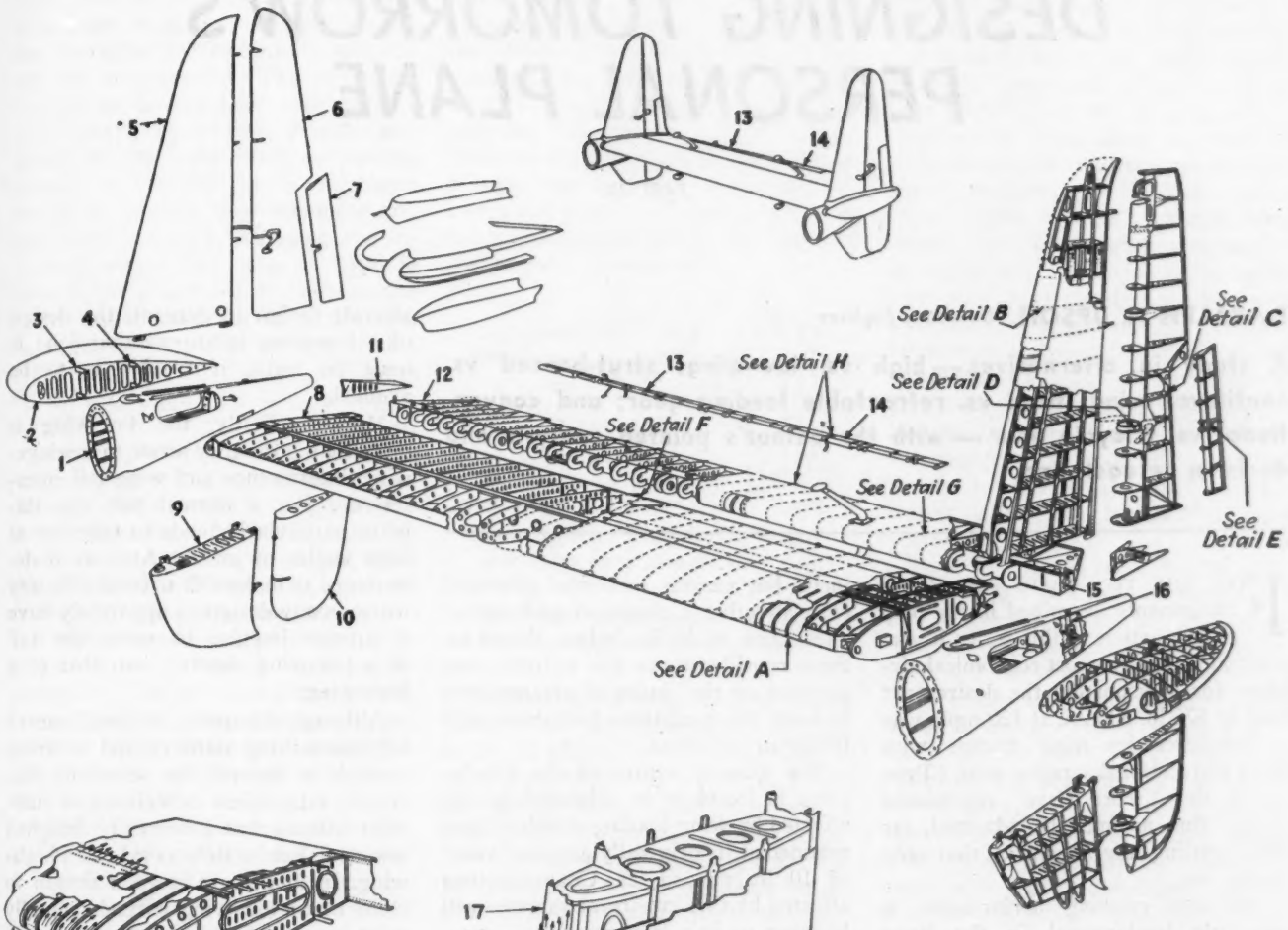
Elevator is of single spar construction having .032 web and single .040 angle cap top and bottom, with nose and trailing edge ribs of minimum thickness. Nose of elevator has metal skin, and the entire surface is fabric covered—similar to aileron. Two tabs, one on each side of the centerline, are also of the same construction, one being the trim tab, and the other a spring tab with special operating mechanism. Each tab is 6¾ in. wide and 93¾ in. long.

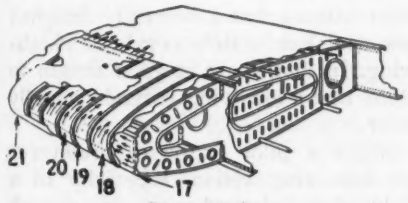
Upper and lower fins are also of two-spar construction with hydropressed ribs and all-metal skin. Spars are of standard web and angle type.

Upper-and-lower rudder has same construction as elevator, with fabric cover doped in place over the metal structure.

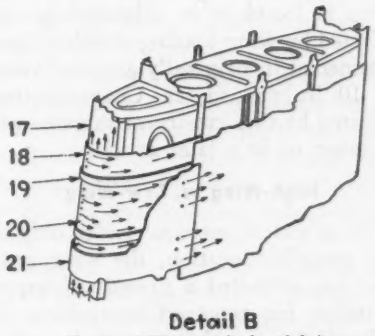
All fixed tail surfaces have anti-icing provisions, with duct in the leading edge, from which hot air flows into an .064 gap between inner and outer skin, thence being exhausted to the outside near the front spar.

Design Analysis of the Fairchild C-82 Packet will be concluded in September AVIATION.

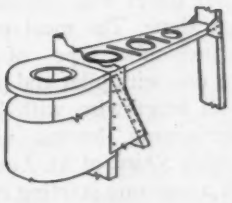




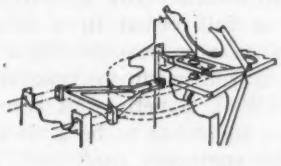
Detail A
Typical Rib and Anti-icing—
Horizontal Stabilizer



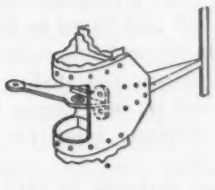
Detail B
Typical Rib and Anti-icing—
Vertical Stabilizer, Upper



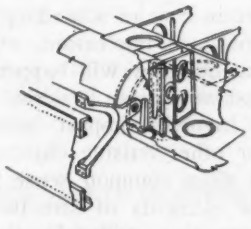
Detail C
Typical Rib—Rudder



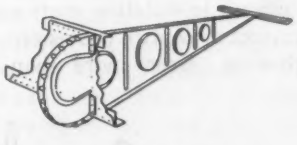
Detail D
Hinge Point—Rudder



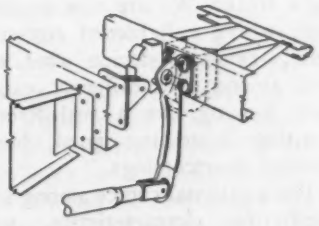
Detail E
Hinge Point—Rudder Tab



Detail F
Hinge Point—Elevator



Detail G
Typical Rib—Elevator



Detail H
Hinge Point and Actuating
Arm—Elevator Tab

Structural details of tail group: (1) Aft boom, (2) stabilizer tip, (3) front spar fitting, (4) rear spar fitting, (5) upper fin, (6) upper rudder, (7) rudder tab, (8) stabilizer, (9) lower fin, (10) lower rudder, (11) clearance piece for rudder throw, (12) elevator, (13) spring tab, (14) trim tab, (15) elevator horn, (16) rudder torque tube, (17) spanwise baffle, (18) inner skin, (19) spacer between inner and outer skins, (20) hot air inlet, and (21) outer skin.

DESIGNING TOMORROW'S PERSONAL PLANE

PART III

By RALPH H. UPSON, *Consulting Engineer*

A study in alternatives — high vs. low-wing; strut-braced vs. cantilever wing; fixed vs. retractable landing gear; and conventional vs. tricycle gear — with the author's pointed analysis and decision on each one.

FOR THE FIVE BASIC DESIGN arrangements examined in the preceding article of this series it was concluded that the most economical airplane for transporting the desired net load of 575 lb. 500 mi. at 120 mph. was a cantilever low-wing tractor with fixed conventional landing gear (Type C, in the "Score Card" reproduced here). But, as must be admitted, far from settling any argument, that only starts one.

Although cruising performance is certainly fundamental in the items wrapped up with a purchased airplane, no average buyer will long be satisfied with that alone. The most economical performance-only type of airplane would be one with pilot and passengers packed in lengthwise with heads and feet overlapping, having vision like Lindbergh's *Spirit of St. Louis*, taking off from a separate starting cradle, and landing on skids. A somewhat modified and restrained adaptation of such a scheme might not be too crazy, especially with takeoff assistance, for those who really want cheap performance and are willing to sacrifice for it.

But more of that when we come back to the engineering fantasies and sideshow freaks. We are now in the main tent, where enlightened conservatism rules, trying to decide what we like best among five different exhibits—each looking like a real flyer, each boasting something good, but none without shortcomings.

For a rational choice among so many conflicting characteristics, we are forced back to comparisons of specific features—which is what we started out with in last month's article. Having seen the way these various features fit into actual tentative designs, and the kind of performance attained, it is now proposed to show in more detail not only reasons for the results already set forth, but various incidental pros and cons affecting a choice in each major alternative of basic design. Based on these considerations, the writer's own decision on the choice of arrangement to meet the conditions laid down will follow in each case.

The general nature of the conclusions is found to be substantially unaffected by wing loading which is here retained at its originally assumed value of 10 lb. per sq. ft. Characteristics affected by this important variable will be taken up in a later article.

High-Wing vs. Low-Wing

To an extent perhaps rivaled only by the propeller location, the wing position has attracted a growth of superstitution far removed from facts. In spite of the fact that two of the safest and easiest to fly of all present planes are low-wing, the idea persists that "low-wing" is somehow synonomous with "tricky" and "hard to fly." A recent article on probable postwar types for personal use repeatedly refers to the low-wing as implying a high-performance airplane relatively unsuited to novice use.

The most that can be said for such ideas is that they may well apply in specific cases, where the characteristics are at least partially related to the wing position. It is true that a low-wing is more difficult to stabilize, more critical with respect to control provisions, than a high-wing. Even more than with aircraft design in general, the design of a low-wing is an exacting job: It must be right, if trouble is to be avoided.

"I'd rather be sitting on this thing—all the time—than have it propped up above me."

More explicitly, the low-wing is more than ordinarily prone to fuselage-wing interference and wing-tail interference. For a normal tail, the stability particularly tends to fade out at high angles of attack. And, as if determined to make this natural difficulty worse, many designers apparently have a strange impulse to make the tail of a low-wing shorter than that of a high-wing.

Although discussion of detail means for maintaining stability and assuring control is beyond the scope of this article, established experience is sufficient witness that a correctly designed low-wing can be fully as safe as a high-wing. In fact, there is good reason to claim that a low-wing is fundamentally safer.

Many a pilot expresses preference for low-wing vision, especially in a light plane where he sits far enough forward to avoid any obscuring of the flight path by the wing. The low-wing is decidedly the writer's preference. In taxiing and takeoff, a simple turn of the head discloses any aircraft above. There is full vision in a turn and tangent to any possible flight path. What if you want to look straight down? Well, sometimes it seems too bad that there has to be a wing, and that the engineers can't just forget about it, as the artist in the advertising department often does. Yet you may sometime be thankful that the wing *is underneath*, to serve as a very real buffer in case of a landing crash.

Accidents are unpleasant, even to talk about, but they will happen even in the best airplanes. Practically any accident involves impact with the ground or other outside objects; and it is just plain common sense to put the major elements of structure and mass where they will take the first shock. A substantial amount of practical experience appears to confirm this conclusion.

The low center of gravity almost eliminates any chance of overturning, and safeguards takeoff and landing in a side wind, especially in view of the

wide wheel-tread so readily obtained with a low-wing. For similar reasons, the low-wing is structurally a more efficient arrangement. The occupants literally sit on the wing and are carried directly by it; the weight (and mass) of the wing itself in landing contact is carried by a minimum length of landing gear members and associated structure. Although the increased weight and drag of Type D over Type C are largely due to the struts rather than the wing position, as such, there is still an appreciable difference between the weights associated with high and low cantilever wings.

Low-wing entrance to the cabin is no particular problem; it is just a little different. Structurally it is lighter and simpler than for a high-wing. On the adverse side, the flaps, rather than the propeller, will in many cases be critical for ground clearance.

A major credit for the low-wing is of course its facility of landing-gear retraction. One of the advantages, in turn, of retractable landing gear is the ability to make a belly landing if necessary. But who wants a high-wing under such conditions?

And finally, with so many examples before us, both military and commercial, of low-wing speed and effectiveness, who in the new generation at least would not pick it for looks and sales appeal?

Although the mid-wing still seems to have a few proponents, it is at best awkward structurally for a small airplane, and it is hard to get the tail plane in the clear either above or below the wing wake.

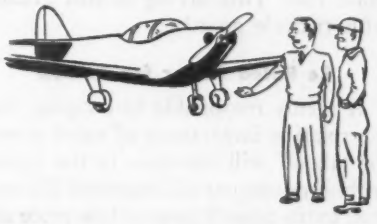
Results of a supplementary biplane study, not here presented, show that it has possibilities superior to the high-wing monoplane although slightly inferior in general to the low-wing. Its one uncontested advantage is its smaller span; but its two wings of greater combined length, with their interconnecting members, mean more parts to assemble, and to that extent greater cost. The tail length can also be slightly reduced, although not in proportion to wing chord. Vision is partially obstructed both up and down.

The decision, for a well designed tractor: *Low-wing*, by a top-heavy score.

Strut-Braced vs. Cantilever Wing

There will be no question as to the considerable drag saving from elimination of external braces. The only serious argument is with respect to the alleged weight and cost penalty carried by the cantilever wing.

The weight comparison cannot in one sense be taken from the tabulated totals for the airplanes here listed, because of the difference in wing position incidentally assumed. Considering, however, that a strut-braced wing virtually has to be in the high position, and that a cantilever wing is usually optimum in the low position, as already brought out, a direct comparison between the wings of Types C and D is fairly representative for the class of planes here considered.



Ernie Engineer: "Designing this tricycle gear is no more pleasure than shaving."

Pete Pilot: "But I like it a lot better than bouncing and ground looping."

But here I can imagine some champion of the strut-braced wing rising to say, in effect: "You're crazy. Where do you get that wing weight of 1.5 lb. per sq. ft.? Why, I can show you a wing 30% lighter. . . ." Quite possible, it must be admitted—but not for the particular degree of conservatism and other conditions here assumed. Such conditions can be changed; but for comparison they must be changed in parallel and kept mutually equivalent.

Consider then a comparison of the wings (including supporting structure) adjusted to carry an equal gross weight with equal structual efficiency. A cantilever wing carrying a gross weight of 2,185 lb. (a little less than Type A), if taken without the tail increment, has a total weight of 318 lb. of which 70 is chargeable to the beam flange elements and associated material (see preceding article). If this latter figure is checked from the weight, load factor, and assumed geometric characteristics applying to the airplane, it will be found liberal enough, for a metal wing beam with center splice, to cover any incidentals that might conceivably fit this weight class. It makes no allowance for CAA's recently proposed load-factor reduction, or for structural improvements now possible.

The equivalent beam-flange elements for Type D, of the same gross weight, total 50 lb. This estimate has to cover not only the spars, but also the struts, fittings, and incidentals, subject to a deduction for the saving in vertical and horizontal (including torque) shear. The latter allowance is somewhat questionable, because even in a fabric covered cantilever wing, there is still little need for added weight either with a leading edge D-spar or diagonal ribs.

But, to be liberal, a weight saving of .005W (over half of the total) has been allowed for this purpose in the strut-braced wing. Even so, the final wing-weight difference comes down to almost nothing, due to the reduced gross weight that the cantilever wing has to carry. The prevailing reputation of a cantilever wing for being heavy (per unit area) clearly has little to do with its being cantilever, but is mainly because most present cantilever wings happen to be designed for relatively high wing loadings and gross weights. For such small difference as there is, the cantilever wing carries the least weight penalty in the field of light planes, just where it has been most neglected.

Now what about cost? Isn't a strut-braced wing much cheaper, even if the ship as a whole is heavier? Prevailing notions on this score can be readily excused; a strut-braced job certainly *looks* cheap. But is it? Take it apart, figure it on any fair basis, and it is found to cost more rather than less.

Remember that this comparison is for wings of the same shape, without taper. For the lighter, tapered cantilever wing, economical production methods may still be developed, but that does not concern us here. Most cantilever wings are all-metal, which offers good possibilities of improved construction, suited to lightplanes, but that subject also will be taken up in due course. What we *are* concerned with here is the fact that the same general type of construction can be used for the two wings.

Although the present comparison assumes metal internal structure and fabric cover, a change will affect both wings alike, whether it be better covering, more economical rib construction, or generally improved fabrication methods. In both wings, the beam or spar elements form the structural backbone and, although the flange section in the cantilever wing must be tapered in area, it needs no detailing of parts and processes to see that with suitable design to provide for beam and torque loads there is no great difference in cost per pound in the wing proper.

Where the difference comes is chiefly in the extra parts outside, which do not exist at all in the case of the cantilever wing. In its best form, a single simple cantilever wing beam combines the major functions of struts, spars, fittings, and carry-through members; and that means production savings in any man's language. It therefore appears more than fair to the strut-braced type to assume that the cantilever wing costs more in proportion to

its weight. Even so, the saving in power, etc., makes the ship cost less.

The compromise of a single strut on each side has proved thoroughly feasible, and offers an improvement over the more primitive two-strut version. But why stop half way? There is no reason why the real goal of a clean, unobstructed wing cannot be reached nonstop.

In combination, the comparison of a cantilever low-wing airplane with a strut-braced high-wing airplane is of course given by the designs represented by Types C and D in the table. In apparent favor of the strut-braced Type D we have more useful load which, however, does no real good except for airport flying, because the entire surplus represents fuel required to overcome the extra drag. Climb is a little better due to the additional power, but is adequate in either case.

In favor of the cantilever type we have less power, weight, and fuel consumption; more top speed; less span and area; and, what is probably a surprise to most people, well over $100 saving in cost. Need more be said?

The decision: *Cantilever wing,* anyway you look at it. Not for nothing has it become the prevailing standard of modern airplane construction.

Fixed vs. Retractible Landing Gear

As brought out in the preceding article, the choice here depends largely on whether you are more interested in takeoff or cruising performance. On the basis of the performance specifications actually used, the total rated power for Types B and C was governed by the maximum power loadings, which made the total power required slightly greater for Type B with retractable gear. Although the power and fuel used at the assumed cruising speed is substantially less, Type B still has a little more gross weight, and more weight empty on which firts cost so largely depends, especially considering the relatively high cost of mechanical parts (estimated selling price at least $3 per lb.).

With cruising as the major criterion, however, this condition is reversed. Then retractable gear permits a real saving in engine power and weight empty, with an actual reduction in purchase cost. This saving is still greater with tricycle gear.[1]

Re Rated Power for Takeoff

It seems reasonable to suppose that the relative importance of rated power for takeoff will decrease in the future with development of improved lift control, extra takeoff power, low-price adjustable propellers, or other takeoff assistance, with a probable increase in the desired cruising speed, and with extensive distribution of more or less standardized airports. Even now, while adhering to the very conservative power loading here assumed, adding 8 mph. to the speed reserve is a considerable inducement for retracting the wheels.

At equal cruising speed, the engine is under less strain; and at equal relative power, cruising speed can be stepped up 6 mph. Put another way, if this result were to be attained by extra power (with attendant added weight and drag), it would take a total of nearly 150 hp., with a generally more expensive airplane, for a "suped-up" version of Type C, compared to Type B.

Incidental advantages of retractable gear include:

1. Ability to make a belly landing;
2. Wheels more accessible for inspection, tire inflation, etc., than with most fixed gear;
3. Slightly better takeoff over an obstacle than can be expected by consideration of wing loading and power loading only, if the gear can be arranged to retract quickly as soon as clear of the ground.

A disadvantage is, of course, the added mechanical complexity, and the always present chance that a preoccupied pilot, in spite of safeguards, will forget to lower his wheels. For this reason, a straight-back partial retraction, with some tread still exposed, makes considerable sense, besides being usually simpler than the fully retracting type.

The decision: For much of the present market, an improved fixed gear will probably get by; in the not distant future, at least partial retraction seems indicated for practically all designs.

Conventional vs. Tricycle Gear

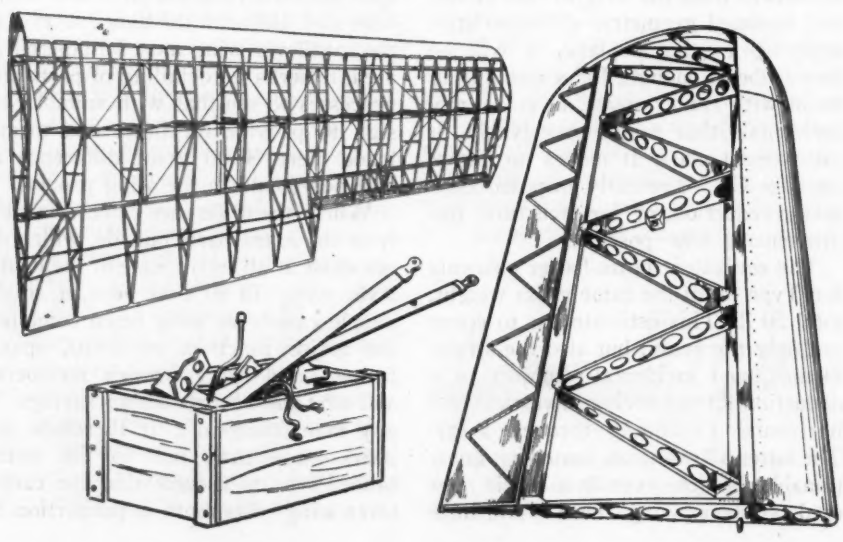
The most concrete starting point here is probably the 80 lb. weight (empty) penalty for the tricycle gear, as represented by the difference between Types A and B. According to our estimated cost scale, the corresponding difference in selling price would be on the order of $250.[2]

Here we have a sizable differential for which there is no direct economic justification, unless it be perhaps insurance. There has been much ballyhoo for tricycle gear, and it sounds good; but most people apparently neglect the fact that there is an appreciable price to be paid for it. One good result of this past neglect is that now we have plenty of experience, not only to establish that it does cost pounds and money, but to survey the results that we are paying for.

For the moment, the recognized advantages of the tricycle gear will be passed over, as having already been adequately presented in a number of technical papers.[3] But in addition to the cost, already mentioned, there are a number of disadvantages not so generally realized.

Most of the trouble with tricycle gear centers in the all-too-vulnerable nose wheel. From available records of lightplanes with tricycle gear, out of 15 accidents involving the landing gear, in only one was any damage or responsibility attached to the main wheels. The nose wheel was the culprit in all the rest. Although permitting no appreciable saving in the main wheels, a nose wheel takes many times more load and general punishment than a tail

"Get a cantilever wing and junk the difference in struts and fittings."



[1] See: "Save Money by Spending It," AVIATION, Sept. 1944.

[2] For retractable gear. Difference in case of fixed gear will commonly run a little more due to higher drag of a nose wheel (and correspondingly greater power required), compared with a tail wheel.

[3] "Tricycle Landing Gear Design," by Jenkins and Donovan, *Journal of the Aeronautical Sciences,* Aug. and Sept., 1942.

wheel. This fact is of course directly responsible for the extra weight. Indirectly, in the attempt to hold this weight down, the nose wheel is usually made too small and its supporting structure too flimsy. Size in itself is an important requirement for the nose wheel, for on its correct behavior the whole success of a tricycle gear largely depends. The rear wheels can bog down, be deflected by ruts, or bumped into the air without serious effect on ground stability and control; but the nose wheel must be able to take it and like it.

Partially related to size also (overall diameter and moment of inertia) is the common disease known as "front-wheel shimmy," which is always a threat even though usually less serious for light planes than for "hot-landing" types.[4]

When of adequate size, a nose wheel is not only heavier than a tail wheel but also has more drag, which in turn means extra weight of fuel, etc., or the alternative weight of retracting means. And retracting a large wheel into the already crowded front end of a tractor fuselage will usually require some compromise of other desirable features.

Another unfavorable feature of tricycle gear on a normal lightplane tractor is the relatively short nose which induces "porpoising" on rough ground, and is responsible for much of the nose-wheel punishment mentioned above. Expressed more fundamentally, the length of wheel base, so important for many reasons, is with the usual tricycle gear not even half of what the length of fuselage makes available.

Although the nose wheel can always be put far enough forward to prevent a direct nose-over, it is still often possible to snag a wing tip, and even to overturn diagonally, should one of the rear wheels leave the ground, due to a combination of forward and lateral intertia (most serious with a high wing). This condition is aggravated by features more or less inherent in "two-control" operation, particularly in a side-wing landing.

Although the general subject of control must be left for later consideration, it is clear that, as at present understood, a two-control system means simply combining directional and rolling functions in a single control. Whether this combination be by mechanical coordination or aerodynamic reaction is immaterial as far as the landing gear is concerned. The point is that if ground steering is put on the same control as air steering, the effect on roll is just reversed, as shown by experience as well as theory.

[4] NACA TR686, "Stability of Castering Wheels for Aircraft Landing Gears," Arthur Kantrowitz.

If you want to raise a depressed wing in flight, you simply apply opposite stick (or wheel) with little or no change in directional heading. On the ground, however, the centrifugal reaction at the wheels, induced by the steering, always overbalances the aerodynamic rolling moment. Thus the same control movement which will raise a wing in the air, invariably tends to depress it on the ground even with the lowest attainable C.G. The stock advice in such a situation, i.e., to drop the control entirely, is sound but not too convincing to a novice with a sudden urge to do something positive.

Mainly dictated by the need for getting the tail down at takeoff, the rear wheels of a tricycle gear are customarily placed but a few inches behind the normal C.G. Under abnormal conditions, it is readily possible to rock back onto the tail, a condition meriting some design attention. Also calling for attention, not always found in the design, is the costly tendency for a muddy nose wheel to throw pebbles into the propeller. Such conditions can be remedied only at some further increase of weight, drag, and cost.

In a similar category is the problem of a nose-wheel brake. With only the customary brakes on the rear wheels, the landing run remains on the order of 50% above the minimum attainable with brakes on all three wheels. This is because of the greatly increased load thrown on the front wheel by the brake-force and inertia couple. Contrary to prevailing supposition, a low-wing monoplane with conventional main wheels well forward, will have a *shorter* ground run than the same airplane with tricycle gear, assuming brakes on the main wheels only. But the added complication of applying a brake to a nose wheel that is already steerable, and usually should be retractable, is an understandable discouragement.

An economic disadvantage of the tricycle gear, best appreciated by airport managers, is that the nose-down method of hangar storage can hardly be used without special holding jigs.

Now that we have disposed of all our brickbats, it seems time to say a few kind words for the tricycle gear, or at least for what it really accomplishes. The situation here can be best summed up by setting forth not what a satisfactory landing gear should *be* but what it should *do*. In the writer's opinion, the following requirements should appear in the "must" column of any lightplane designer appealing to the novice pilot:

1. **The design must be such as not to require landing in any critically stalled condition.**
2. **There must be a substantial range between minimum and maximum landing speed, within which there is no tendency to bounce or balloon up after ground contact.**
3. **Ground attitude must be such as to provide unobstructed forward vision.**
4. **Ground steering must be as simple and positive as in an automobile.**
5. **There must be no vicious ground-looping tendency.**
6. **Ground stability against overturning must resist even full brake application and steering in the wrong direction.**
7. **Strength must be adequate to cover the condition named above (6).**
8. **Take off must be possible at any speed above a reasonable minimum, preferably a little above minimum flying speed.**

The tricycle gear comes closer to meeting these basic requirements than anything realized to date. Conditions (1), (2), and (3) are met by the low ground angle, (4) by the steerable nose wheel, (5) by the non-castering wheels behind the center of gravity. Conditions (6) and (7) are not yet fully realized but can be at least closely approached with a low-wing arrangement and some added weight. Condition (8) is determined by the longitudinal position of the rear wheels.

In view of this proven versatility, if forced to choose between the present conventional gear and tricycle gear in its present form, I should unhesitatingly choose the latter, with all its faults. But perhaps the last word hasn't been said. If someone can devise means for realizing the essential advantages of the tricycle gear without its serious disadvantages, particularly its extra weight and cost, the world will make a beaten track to his door.

The decision for the class of plane under discussion, though it hurts to say so: *Tricycle gear*, if you can't dream up anything better.

And, finally, we come to Pusher vs. Tractor—but that's a story in itself which will be presented in the next issue.

Analysis of Magnesium Applications In German Aircraft and Equipment

By **F. A. RAPPLEYEA,** *The Dow Chemical Co.*

Study of new uses of forgings, sand and die castings in BMW-801D and DB-601E engines, and Fungerrat radio reveals Nazis used alloys similar to ours; their techniques showed no superiority.

ANALYSIS OF CAPTURED Nazi aircraft shows that while the Germans had developed many new applications of magnesium alloys, the compositions of these alloys and their design principles were definitely not superior to those of this country.

This has been proved in earlier studies [1] and again in examination of parts of BMW-801D and DB-601E engines, a Fungerrat radio and a camera support casting, all submitted for study by the Air Technical Service Command.

Magnesium alloys accounted for approximately 10% of the dry weight of both the engines, a ratio similar to that found in the earlier models which were of slightly lighter weight. Magnesium alloy parts of the radio were mostly die castings. This piece of apparatus was standard field equipment and although large and bulky, was apapparently portable to some extent. Such service, of course, subjected it to effects of the elements.

Table I shows the magnesium alloys used in these units and also shows the nominal composition and the American equivalent. Most popular casting alloys used in German was AZG and A9, the former being used in the as cast state, the latter usually in the solution heat treated state. The German AZ91 alloy is the principal alloy used for die casting, although alloy A8 is sometimes used for simple die casting liable to impact stresses. Elektron alloys AZM and AM6 were used for forgings. The AM6 alloy is particularly applicable where high temperatures are encountered.

Sand casting applications of the BMW-801D engine are shown in Fig. 1 through 6; those of the DB-601E are shown in Figs. 7, 8 and 9. Die casting applications of the Fungerrat radio are shown in Figs. 10 and 11; similar applications of the DB-601 in Figs. 12 and 13.

Most interesting forgings were found in the BMW engine, as shown in Figs. 14 through 17. Outstanding example of a large engine mount forging —for the DB-601—is shown in Fig. 18. AZM alloy was used for this as well as the smaller forged attachment fitting, shown in Fig. 19.

Distribution of Parts

In order to determine the popularity of the alloys used, Table II gives a summary of the number of articles for each alloy, which shows that the more popular sand cast alloys are AZG and A9V, one in the as cast condition, and the other in the solution heat treated condition. Although previously [1] some solution heat treated and aged alloys were found, none were seen in this investigation. Only one part—the DB engine oil pan—was found in the as cast and stabilized condition.

In the die castings, where resistance to impact was desired, the A8 alloy was used. In general though, the principal alloy for all kinds of die castings was AZ91. Only a relatively small number of the parts studied were forgings; these encompassed a relatively large percentage of the poundage. Alloy AZM is the principal alloy used for highly stressed forgings, except where elevated temperatures are encountered, in which case AM6 alloy, an alloy characterized by good mechanical properties at these temperatures, is used. In the other investigation [1] Elektron alloy AZ855 was commonly used for large forgings.

Wherever it was possible to obtain

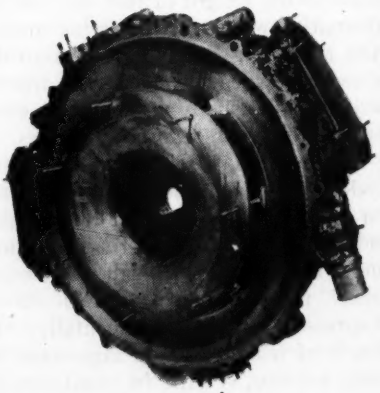


Fig. 1. Blower housing of BMW-801D engine, a 54-lb., intricate casting of A9V alloy which is similar to Dowmetal A used in this country. Note liberal use of studs with very few inserts. Sections are blended quite nicely with liberal fillets throughout. Although continual flow of air was present, inside surfaces showed no sign of corrosion and just slight etching effect.

Fig. 2. Another intricate casting—weighing 37 lb.—on BMW-801D engine, an intermediate case attaching to blower housing by 19 stud bolts shown in Fig. 1. Note that some supercharger vanes are integrally machined.

[1] References are listed at end of article.

TABLE I — Designation And Composition Of German Alloys

German Designation	Nominal Composition Al %	Zinc %	Mn %	Ce %	Condition	U. S. Equiv. Dowmetal Alloy
AZ31	3	1	0.3	...	Sand Cast	FS*
AZF	4	3	0.2	...	Sand Cast	.....
AZG	6	3	0.2	...	Sand Cast	H
A9	8.5	0.5	0.2	...	Sand Cast	R**
A9V	8.5	0.5	0.2	...	Sand Cast and solution heat treated	R HT**
AZ91	9.5	0.5	0.2	...	Die Cast	R**
A8	8	0.5	0.2	...	Die Cast	A***
AZM	6	1	0.2	...	Forging	J
AM6	...	...	2.0	6	Forging	.....
AZ31	3	1	0.3	.....	Extrusion	FS

*FS is commonly used as an extrusion alloy in American practice.
**Nominal composition of R alloy is 9% Al, 0.6% Zn and 0.2% Mn. R alloy is commonly used for die castings in American practice.
***Dowmetal A alloy is commonly used for sand castings in American practice.

test specimens, mechanical properties were determined. The average results obtained from tests of the castings together with German specifications are given in Table III. All of bars cut from the castings exceeded German specifications for bars cut from castings. In some cases, the average properties were far greater than the specifications.

Since the forgings were used as stressed parts in most cases, a detailed account of the mechanical property data is given in Table IV with a summarization of the averages in Table V. The uniformity of forgings is evident from a comparison of the properties taken at different angles in the forgings. Metallographic examination showed the forgings to be very homogeneous throughout. Quite evidently the transverse properties were improved by restricting segregation and by proper orientation, the latter being the more important factor.

These properties, as given, come up to those properties obtained on similar alloys in this country. This statement is based on experience of tests on many American castings and forgings by different investigators.[1]

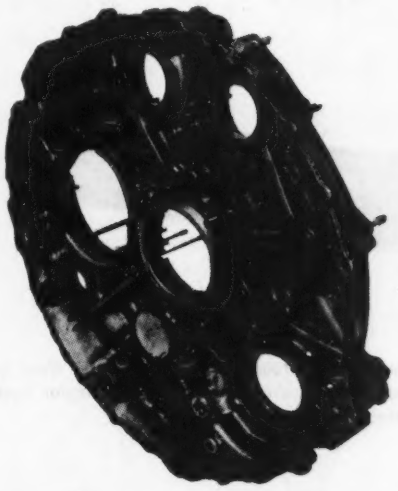


Fig. 3. Rear cover of BMW-801D engine, an A9V casting weighing 19 lb. Steel and brass liners are used for protruding shafts from engine end. Study of this part revealed no evidence of distortion or wear.

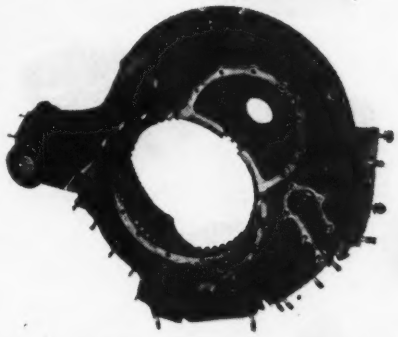


Fig. 4. BMW main nose casting. Note that gear teeth are machined from casting itself. Like rear cover, this part showed no evidence of distortion or wear.

Fig. 5. Main oil pump of BMW, made of AZG alloy, which corresponds to American Dowmetal H alloy. In accordance with German custom, this part was used in as cast condition.

Soundness

All castings were inspected radiographically. These radiographs were then evaluated in the following manner.[2] A variac voltage recorder was used so that voltage readings could be made when the porosity was just discernible as seen through the viewing screen. The percentage areas of porosity were also noted and the radiograph evaluated qualitatively as follows:

Variac Reading Volts	*% Area of Porosity*	*Rating*
45–50	0–100	Very good
40–45	0–40	Good
40–45	41–100	Fair
35–40	0–40	Poor
35–40	41–100	Very poor

Using the above as a guide, the castings were found to be generally fair to good; a few pieces were excellent and a few were poor. At points of stress concentration and at surfaces which required machining care must have been taken to obtain good sound sections. Elektron AZG showed the greatest amount of microporosity; A9, a lesser amount and AZ31 the least. The surface of the castings did not

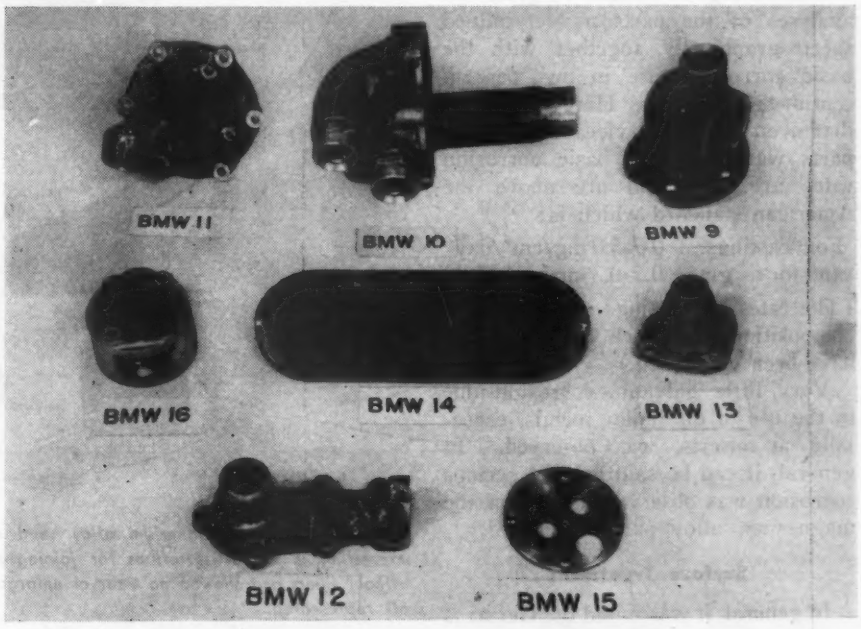


Fig. 6. Group of small magnesium alloy parts used in BMW-801D engine. Castings in this group are AZG or A9V alloy except that labeled BMW 11 (upper left) which is AZ31. Items marked BMW 14, 15 and 16 are of wrought AZM alloy, item 14 is forged butterfly valve from oil blower and item 16 is small forged oil pump body. Item 15, a small end piece used on oil pump housing, was machined from rolled plate.

TABLE II — Number Of Articles For Each Alloy And Condition

Alloy	Nominal Composition	State	Number of Articles
AZ31	3 Al, 1 Zn	Sand Cast	4
AZF	4 Al, 3 Zn	Sand Cast	1
AZG	6 Al, 3 Zn	Sand Cast	14
AZG	6 Al, 3 Zn	Sand Cast, and solution heat treated	1
AZG	6 Al, 3 Zn	Sand Cast and stabilized	1
A9	8-1/2 Al, 1/2 Zn	Sand Cast	6
A9V	8-1/2 Al, 1/2 Zn	Solution heat treated	23
AZ91	9-1/2 Al, 1/2 Zn	Die Cast	13
A8	8 Al, 1/2 Zn	Die Cast	10
AM6	6 Ce, 2 Mn	Forging	2
AZM	6 Al, 1 Zn	Forging	7
AZM	6 Al, 1 Zn	Plate	4
AZ31	3 Al, 1 Zn	Extrusion	2
			88

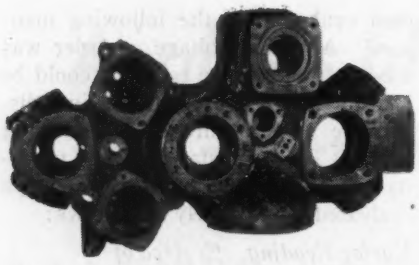


Fig. 7. Daimler Benz DB-601E engine accessory housing, an example of German practice in magnesium sand casting. This piece shows change from previous DB-601 engines, having fewer ribs and different hole spacings.

come up to the standard of surfaces of American castings.

Corrosion

Although no corrosion was observed on the engine parts, some was noticed on eleven die cast parts, but in no case was the corrosion severe or extended over a large area. The basic corrosion resistance of the parts was determined by testing ground specimens in a 3% NaCl solution using alternate immersion at 95 deg. F. Table VI gives the analyses of the parts as determined spectrographically, together with the basic corrosion rate in mg. per sq. centimeter per day. Here it is seen that even though serviceability of the parts was good, the basic corrosion rates are high and are above the American standard which is:

For castings... 0.5–5.0 mg/cm²/day
and for forgings 0.2–0.3 mg/cm²/day

(The rates on forgings apply to those compositions in which the impurities have been controlled.)

Very little galvanic corrosion due to the use of dissimilar metals, especially at inserts, was observed. In general, it can be said that no serious corrosion was observed on any of the magnesium alloy parts examined.

Surface Treatment

In general, it was found the Germans used but one surface treatment, one corresponding to the American Chrome-Pickle. There were a few isolated cases, i.e., the supercharger impeller, aid scoop grid and some other small parts, on which no treatment had been applied. Previously, the Germans had the practice of Chrome-Pickling before machining only, and after machining, rather infrequently. However, the trend as indicated by the study of these engines changed so that now usually all parts get a Chrome-Pickle treatment after machining.

In most cases the parts had no primer. Only a single coat of black paint was used for the engine parts. Seven of the die castings were given a primer; five, a rust colored primer; one, a white and one a light blue. Total thickness of coating varied from 7 to 30 mils as compared to the American standard four coat system of 3 to 3.5 mils. Adhesion of the coatings varied considerably, ranging from poor to fair. On many of the parts the coating could be chipped or flaked off quite easily. A spectrographic analysis, giving from 1–10% Cr in the black top coat would quite possibly indicate the use of an inhibitive chromate pigment.

Six different colored top coats were observed on the die castings, making a total of ten different systems. This is quite unusual and may be attributed to various manufacturers of the items. The general conclusion is that the painting practice of the enemy is below acceptable American standards. However, even with the poor basic corrosion resistance, a chemical treatment inferior to American standards, and the poor paint used, almost no evidence of corrosion was observed.

Metallography

The microstructures of all parts were normal with grain size about the same as observed in American practice, that on the forgings running about 0.0005 in. Heat treatment of the cast-

TABLE III — Average Mechanical Properties And German Specifications Of Magnesium Alloy Castings From Enemy Equipment

Alloy	*Ultimate Tensile Strength Test	*Ultimate Tensile Strength Spec. Min.	*Tensile Yield Strength Test	*Tensile Yield Strength Spec. Min.	Elongation % in 2 in. Test	Elongation % in 2 in. Spec. Min.	*Compressive Yield Strength Test	Brinell Hardness Number Test	Brinell Hardness Number Spec. Min.
AZ31	24.5	11.4	8.6	5.7	9.0	1.5	9.6	41.9	.....
AZG	19.0	12.8	13.4	11.4	3.0	1.0	17.7	51.2	50–60
AZGs	21.0	....	14.5	....	1.5	...	....	52.4	.....
A9	23.9	....	15.1	....	4.0	...	12.1	51.8	.....
A9V	30.0	17.1	15.5	12.8	6.2	2.0	14.6	50.1	50–60
AZ91	25.2	....	19.6	....	1.5	...	20.3	53.6	.....
A8	20.7	14.2	19.8	11.4	1.6	1.0	18.9	57.8	45–55

* 1,000 psi.
German specifications are for bars cut from castings.

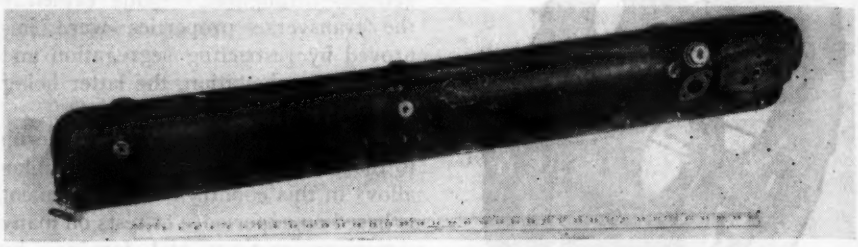


Fig. 8. DB-601E oil pan, largest magnesium sand casting found on that engine. Used in as cast and stabilized condition, it was only application studied having this particular heat treatment. Cracks were caused by bullet going through the piece.

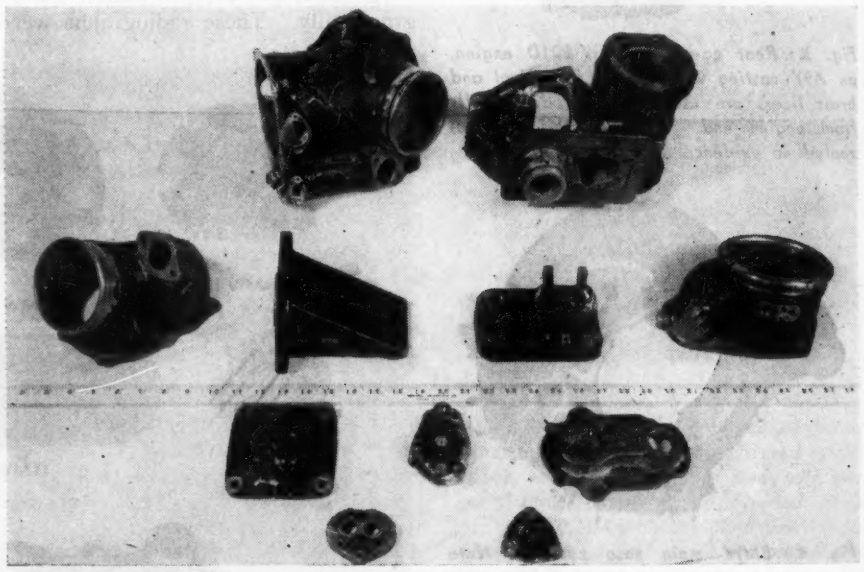
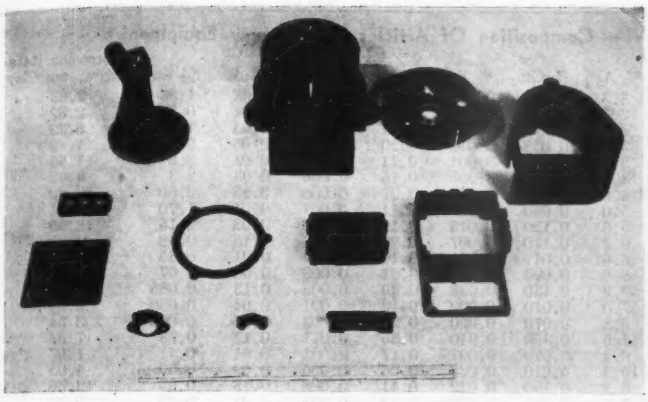
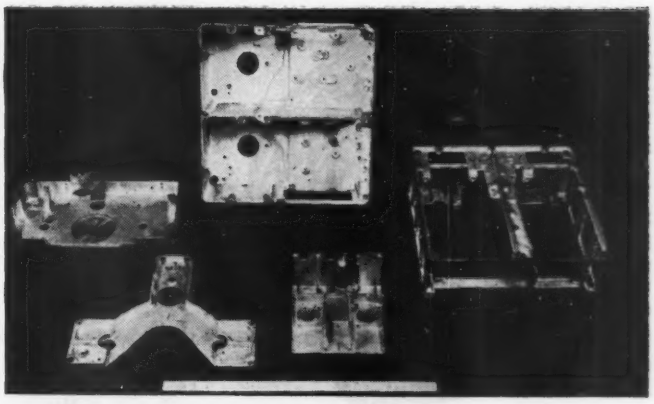


Fig. 9. Group of magnesium alloy sand castings used on DB-601E engine. Particularly interesting is use of serrations for joining surfaces of camshaft bearings, which were used without liners and showed no wear or enlargement. Elektron alloys A9V, AZG and AZ31 are all represented.





Figs. 10 and 11. Magnesium alloy die casting examples found on German Fungerrat radio. Evidently several movable cores were required to make these castings. In order to make internal lugs, bosses were die cast full length along side and excess material routed out, leading to non-uniformity of section. Biggest fault with German die cast designs is non-uniformity of section. Certain lips 0.076 in. thick ran into wall section 0.320 in. thick, leading to poor metal flow and shrinks in casting production. These parts are of AZ91 or A8 alloys, which are somewhat similar to Dowmetal R used in this country. Foot rules at bottom indicate size of units.

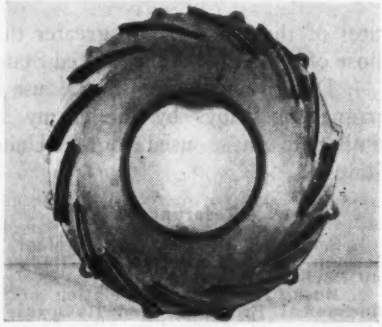


Fig. 12. Largest die cast item used on DB-601E engine, a part embodying supercharger diffuser vanes. This part is of AZ91 alloy.

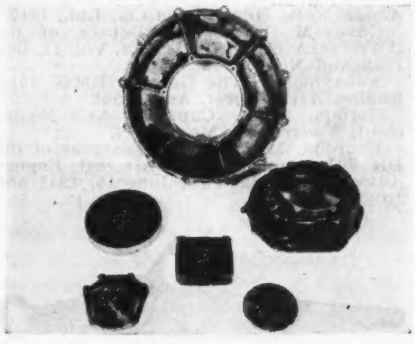


Fig. 13. Typical die castings found in DB-601E. Of particular interest is air scoop grid (left center) and twin magneto housing cover (right center). Air scoop grid had no surface treatment and was in excellent condition, while magneto housing cover was nicely designed to prevent radio interference. Die casting alloys AZ91 and A8 were used for these parts.

TABLE IV — Mechanical Properties Of Forged Elektron Alloys From Enemy Equipment

Alloy	Part	*Ultimate Tensile Strength	*Tensile Yield Strength	Elongation % in 2 in.	*Compressive Yield Strength	Brinell Hardness Number
AZM.....	DB 601E Engine Mount (Flange 30°)	47.2	31.6	15.0	22.2	55.6
	DB 601E Engine Mount (Web-Long.)	46.2	31.6	14.1	18.3	55.6
	DB 601E Engine Mount (Web-Trans.)	44.9	27.4	15.0	....	56.0
	Engine Shock Pad and Mounting Ring BMW 801D (0°)	46.0	29.8	11.8	16.0	60.3
	Engine Shock Pad and Mounting Ring BMW 801D (90°)	46.3	29.6	15.0	20.0	63.4
	Oil Cooler Fan (0°) BMW 801D	45.0	33.1	13.0	20.2	65.5
	Oil Cooler Fan (30°) BMW 801 D	45.3	31.6	13.0	20.2	65.5
	Oil Cooler Fan (60°) BMW 801 D	45.9	32.4	13.0	21.2	65.5
	Oil Cooler Fan (90°) BMW 801 D	45.8	32.8	13.0	22.7	64.5
	Butterfly Valve from Oil Blower 801D	44.7	33.4	14.5	22.3	62.1
AM6.....	Cam Followers' Guide and Housing BMW 801D	40.5	31.9	7.0	21.2	67.4
	Supercharger Impeller BMW 801D	36.4	30.8	3.0	20.8	60.8

* 1,000 psi.
All values are averages of two or more tests.

TABLE V — Average Mechanical Properties And German Specifications Of Magnesium Alloy Forgings

	*Ultimate Tensile Strength		*Tensile Yield Strength		Elongation % in 2 in.		*Compressive Yield Strength	Brinell Hardness Number	
Alloy	Test	Spec. Min.	Test	Spec. Min.	Test	Spec. Min.	Test	Test	Spec. Min.
AZM L.....	45.6	40.0	29.5	27.1	13.8	6.0	20.0	63.1	50
T.....	44.9	28.5	27.4	17.1	15.0	3.0	20.0	63.1	50
AM6.....	37.7	....	31.1	....	...	4.3	21.0	63.0	....

* 1,000 psi.

ings was usually satisfactory as evidenced by the solution of the magnesium-aluminum compound. All the forgings were very homogeneous, although in the case of the supercharger impeller on the BMW there was a little evidence of the as cast dendritic structure still remaining. No fusion voids of the castings were noted.

A general summary of the design features studied shows the following principles:

1. Minimum edge distance of bolts = 0.6 d
2. Depth of stud holes = 2.0 d
3. Liberal fillets on forgings and castings
4. Close fit and fine thread on most threaded applications
5. Liberal use of inserts for bearing surfaces; however, where studs were used, they usually lacked inserts.

The BMW supercharger impeller was keyed to the drive shaft by means of splines in the magnesium alloy forging. When compared to a similar American design, the splines on this impeller were apparently overstrength.

A detailed study of the forgings showed the following general German practices: Draft angles 5–10 deg., fillet radii $\frac{3}{4}$ in., corner radii $\frac{1}{8}$ in.

Small rivets were found and by spectrographic analysis were determined to be similar to 56S aluminum alloy in composition. Ball bearings

Fig. 14. Example of forging application on BMW-801D engine, cam follower guide and housing. This large, intricate casting was composed of AM6, a creep resistant alloy differing from those commonly found in German aircraft.

TABLE VI — Composition Of Articles From Enemy Equipment

Alloy		% Al	% Cu	% Fe	% Mn	% Ni	% Si	% Zn	Corrosion Rate mg/sq. cm./day
AZ31.....	Max.	3.3	0.110	0.040	0.78	0.009	0.08	1.35	7.83
	Min.	2.7	0.042	0.001	0.25	0.001	0.01	0.72	2.82
	Average	3.0	0.076	0.020	0.51	0.005	0.04	1.03	5.32
AZF.....	Max.	3.9	0.018	0.010	0.20	0.006	0.05	2.4	1.49
	Min.	3.0	0.011	0.001	0.11	0.001	0.01	2.2	1.36
	Average	3.5	0.015	0.005	0.15	0.003	0.03	2.3	1.42
AZG.....	Max.	6.0	0.190	0.022	0.27	0.006	0.15	2.60	22.90
	Min.	5.0	0.050	0.007	0.11	0.001	0.01	1.70	2.91
	Average	5.5	0.120	0.015	0.19	0.003	0.08	2.15	12.90
A9.....	Max.	9.3	0.170	0.007	0.26	0.006	0.15	0.98	39.30
	Min.	6.6	0.017	0.001	0.16	0.001	0.01	0.35	1.85
	Average	8.0	0.093	0.004	0.21	0.003	0.08	0.67	20.57
A9V.....	Max.	9.2	0.130	0.038	0.30	0.008	0.13	0.085	515.00
	Min.	7.0	0.010	0.002	0.12	0.001	0.01	0.030	2.08
	Average	8.3	0.070	0.020	0.21	0.003	0.07	0.058	258.54
Az91.....	Max.	11.5	0.350	0.040	0.35	0.011	0.17	0.78	7.04
	Min.	8.9	0.070	0.001	0.17	0.001	0.01	0.41	1.07
	Average	10.2	0.210	0.020	0.26	0.006	0.09	0.60	4.05
A8.....	Max.	8.9	0.190	0.022	0.41	0.008	0.18	0.85	12.60
	Min.	7.6	0.011	0.001	0.12	0.001	0.01	0.48	0.55
	Average	8.1	0.100	0.021	0.26	0.004	0.09	0.67	6.58
AZM.....	Max.	7.1	0.079	0.012	0.28	0.011	0.04	1.10	75.30
	Min.	5.6	0.010	0.003	0.05	0.001	0.01	0.67	5.95
	Average	6.3	0.045	0.007	0.16	0.006	0.02	0.89	40.67
*AM6.....	Max.	0.01	0.010	0.005	1.8	0.001	0.01	0.01	0.35
	Min.	0.01	0.010	0.004	1.6	0.001	0.01	0.01	0.29
	Average	0.01	0.010	0.004	1.7	0.001	0.01	0.01	0.32

* Total rare earths including cerium 6.35% Max., 6.15% Min., 6.25% Average.

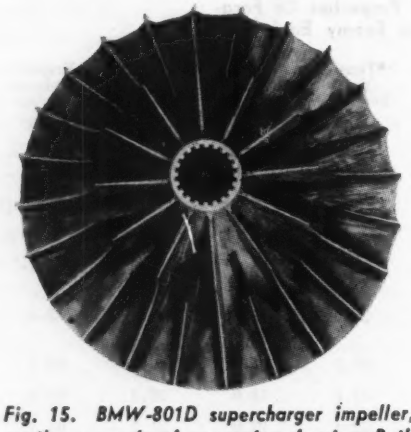


Fig. 15. BMW-801D supercharger impeller, another example of magnesium forging. Both it and part shown in Fig. 14 are subjected to stresses at moderate temperatures, and selection of magnesium-cerium-manganese alloy appears excellent choice.

Fig. 16. Another large magnesium forging is this BMW engine shock pad and mount ring, a large part made of AZM alloy.

were mounted in steel inserts in several items. When pushed out, the force required was determined and was found to correspond to an intereference of 0.0015 in./in. of diameter.

A study of thicknesses showed a minimum sand casting thickness of 5/32 in. and die casting thicknesses varying from 0.0947 to 0.1470 in., corresponding to American practice. Some lips, however, were found to be only 0.076 in. thick.

Conclusions

1. Rather extensive use of forgings in magnesium alloys was made by the Germans and care was given to choice of alloy for high temperature applications.

2. Compositions used for magnesium did not differ materially from those in the United States, although usages of the alloys in various conditions do differ. For example, the Germans use AZG in the as cast condition, where the corresponding American alloy, Dowmetal H, is used in the solution heat treated condition, and Elektron A9, similar to Dowmetal A or R approximately is used for sand castings and is usually used in the solution heat treated condition. These are the two major German sand casting alloys.

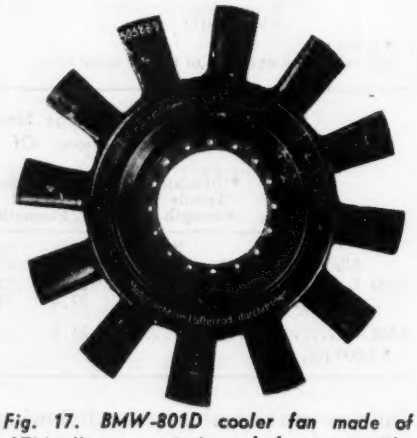


Fig. 17. BMW-801D cooler fan made of AZM alloy, a part stressed due to centrifugal force.

3. No serious corrosion resulted in service even though the basic corrosion rates of the metals were greater than those of the alloys of the United States.

4. Design principles in the use of magnesium alloys by the enemy are similar to those used in the United States.

References

1. Schmidt, H. W. Magnesium in German Aircraft, *Aeronautical Engineering Review*, June 1943.
2. Busk, R. S. A Correlation of the Mechanical Properties and Radiographic Appearance of Magnesium Alloy Castings. *A.S.T.M. Transactions*, 1943.

Additional sources are as follows:

Erlenbach, A. and Beck, A. Some German Aircraft Light Alloy Material Specifications, *British Air Ministry Translations, 1654*.

Beck, A. The Technology of Magnesium Alloys, F. A. Hughes and Co., Ltd., 1940.

Cave, M. V. Design Details of the BMW 801A Engine AVIATION, Vol. 41, Oct. 1942 and Nov., 1942.

Anonymous. The German BMW 801A Engine, *Aero Digest*, Aug., 1942.

Gordon, R. A. Captured Axis Equipment, *Electronics*, Mar., 1944.

Bourdon, M. W. Some Features of the DB 601 Liquid Cooled Aircraft Engine, *Automotive Industries*, June 15, 1941 and July 15, 1941.

Fig. 18. DB-601E forged engine mount, designed with liberal fillets throughout. It is comparable in size to magnesium alloy forgings made in this country. AZM alloy was used for large forging.

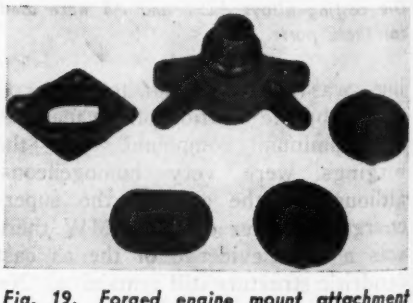


Fig. 19. Forged engine mount attachment fitting for DB-601E engine. Like engine mount itself, these were of AZM alloy.

Aeronautical Supremacy Demands Jet and Rocket Research

PART II

• *Because much of the general public's conception of rocket applications has been limited almost entirely to publicity about the Nazi's V-2, the author here explains other important "on-the-ground" uses—both actual military and as a means of conducting research, in addition to indicating probable future trends of investigation.*

By ROY HEALY, *Vice-President, American Rocket Society*

Concluding this vital series, the author points to the need for continued study to develop defensive as well as offensive weapons, and points to possible peacetime uses for these "new" forms of power.

VIRTUAL LACK OF RECOIL, enabling shouldering of an anti-tank weapon, has made the Bazooka one of the more important new devices introduced by this war. Its ingenious hollow-charge head allows its low-velocity projectile to achieve the same armor penetration as a high velocity cannon-fired shell.

The imitative but larger German version, incorporating several slight improvements over the initial American models, spurred the research on more powerful projectiles for this launcher, and these missiles are now being delivered to the fighting fronts. Postwar research on anti-tank rockets is a prime necessity, the main goals being increased penetration and greater range with accuracy. The appearance of rocket pistols, rifles, and light automatic guns firing 20-mm. and even larger high explosive rocket shells, may be expected. Such weapons may contest the present position occupied by light arms firing solid bullets.

Chemical and Incendiary Rockets

For laying heavy smoke screens, or firing grass and tree covered terrain, the chemical rocket shell has proven, in many respects, far superior to other methods. As accuracy is not a prime consideration, low velocity shells, hurling heavy cannisters of chemicals, can quickly blanket an enemy position. If gas warfare is ever resorted to, the rocket shell will be a major mode of spreading deathly asphyxiation.

Long Range Rocket and Jet Bombs

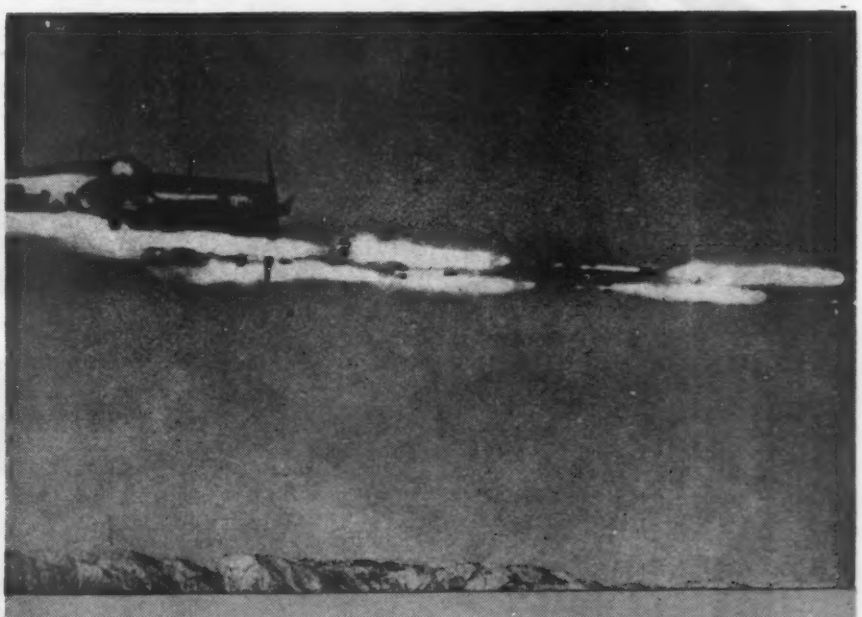
The ghastly preview of future wars afforded by the introduction of the thermal-jet-propelled Nazi V-1 and the terrifically fast V-2 rocket bomb should be ample warning of the frightful results of any further world conflict. The United States must not only strive to gain supremacy in this field, but must remain constantly aware of the status of long-range projectile research in other countries. It has been proposed that an international body be set up to control experiments with long-range rocket projectiles—certainly an admirable contention but one unlikely to succeed in this suspicious world.

The long-range rocket attack, unheralded and unseen, may well play a major part in future warfare. Used both offensively and defensively—as has been Nazi practice—such missiles could be launched either from shipboard or from land bases.

A combination of the concentrated power of the rocket with the more economical operation of the thermal-jet, or the athodyd duct, may make intercontinental bombing a definite threat and conceivably could eventually replace the bombing airplane with its highly trained crews and vulnerability to defensive weapons. Problems posed in the control, by electronic devices of the entire flight of a long-range projectile are not insurmountable. The present random falling of V-2 bombs may be superseded by pinpointing of targets.

V-2 Counter Weapons

The only truly successful counter measures taken to date against the long-range rocket projectile have been bombing of launching sites and factories producing the component parts and of transportation facilities leading to



New type HVAR rockets are shot from Vought F4U Corsair during tests at Navy's ordnance test station at Inyokern, Calif. This type rocket requires no launching tube, as did predecessor types.

the firing points. Capture by the British armies of the launching bases in Holland was necessary to entirely curb the continuous V-2 bombing of London.

In the initial stages of a future attack, the former measures will be neither satisfactory nor feasible. How, then, to down the long-range rocket bomb? It appears doubtful if cannon fired anti-aircraft, even radar directed, will be capable of conversion into a successful defense. Ray beam weapons —no more fantastic than a 10-ton rocket plunging down from the upper reaches of the stratosphere—offer some possibilities; but results so far attained have been scanty.

Of more immediate promise are super-fast "hunter" rockets, attracted to their target by electronic devices and capable of intercepting the long-range rocket bomb at high altitudes. Designed for comparatively short ranges of flight and utilizing the step-rocket principle—casting off fuel sections as their contents are exhausted and becoming smaller as it accelerates —the hunter rocket could reach speeds of over 6,000 fps.

Within the realm of possibility are aerostatic launching platforms, drifting slowly above the more important defense zones at altitudes of 10 to 15 mi., each carrying one or more hunter rockets ready for launching at any object caught in the long-range radar beams. By thus eliminating the need for a climb through the dense layers of the atmosphere, these platforms would allow tremendous velocities to be attained by the "hunter" rockets.

Liquid-Fuel Rocket Motors

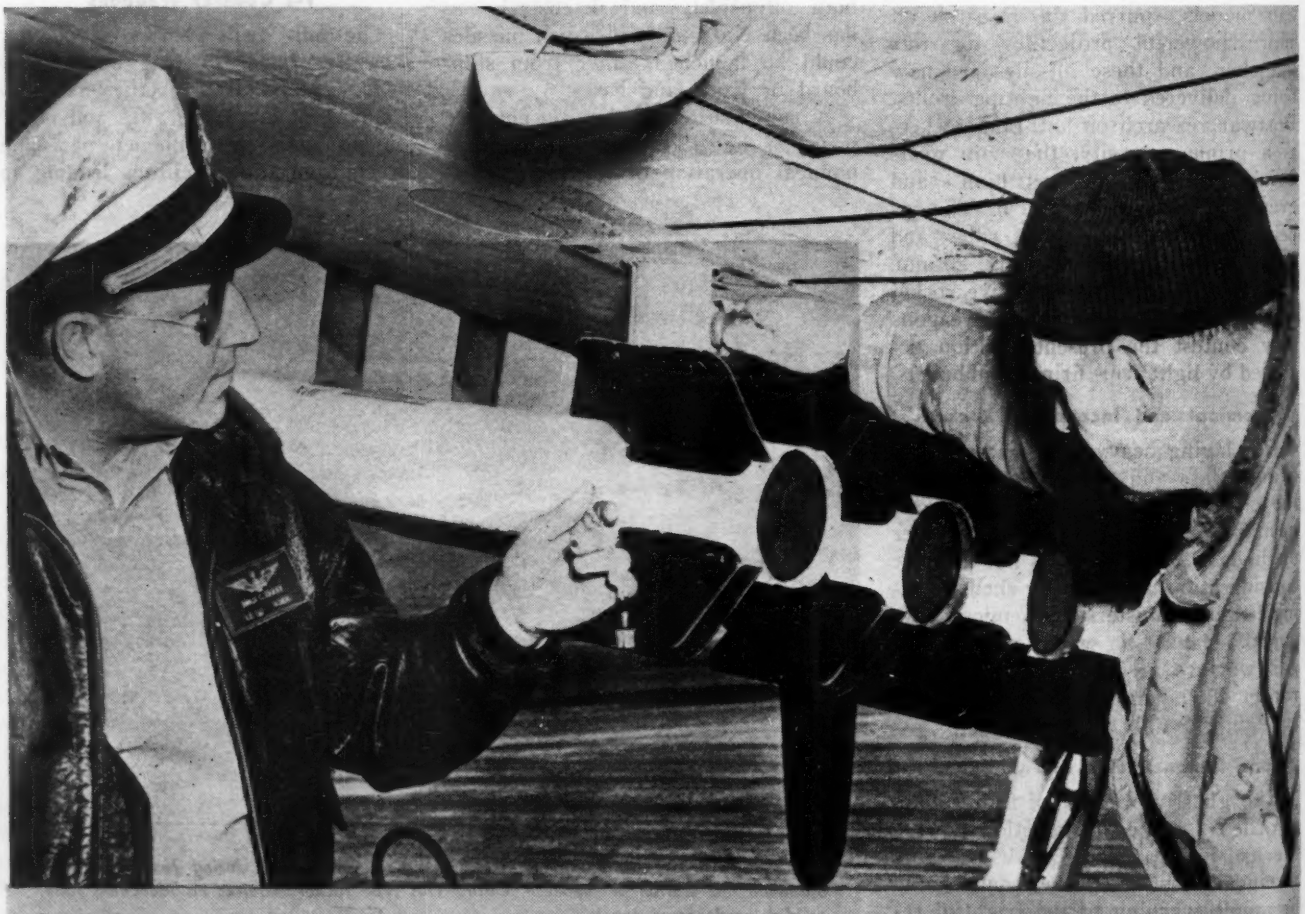
Great advances have been made in the past few years in the development of liquid-fuel rocket motors, both in this country and abroad. Use of improved materials and propellants has enabled the realization of rocket units whose thrusts are measured in tons. Successful use of a rocket motor developing an estimated thrust of 50,000 lb. for a period of over one minute enabled the Nazis to spring one of the major surprises of the war in their V-2. Introduction of this weapon, and more lately the rocket powered Me-163 interceptor airplane, reveals the German lead in this field. Large scale research in this country got off to a late start, but it is now rapidly gaining ground. Jet assisted takeoff, predicted in these pages two and one-half years ago (see "Rocket Power for Assisted Takeoff," Jan. 1943) has since been put into combat use by the Navy, both for carrier takeoffs and for emergency takeoffs of flying boats after sea landings.

However, despite the improvements thus far achieved with liquid-fuel rocket motors, the terrific fuel consumption rate per power output has not been reduced below the best figures of 1 lb./sec. of propellant consumption per 200 lb./sec. thrust obtained by experimenters several years ago.

The natural efficiency of larger combustion chambers has helped somewhat, but the liquid rocket is still voracious in its fuel needs. This is somewhat balanced by its amazingly light weight, which can easily be kept below 25 lb. per 1,000 lb. thrust.

Somewhat surprising to rocket experimenters of prewar days was the disclosure that the majority of takeoff units being used were utilizing a solid fuel charge. Because of the simplicity, ease of transport and handling, lack of plumbing, valving, pressure feed and evaporation losses, the solid-fuel motor, with its fuel formed inside the combustion chamber, has gained the ascendancy for assisted takeoff and for other utilizations where a short duration burst of power is desired.

The "dry" fuels of today are a far



Detail photo showing simple method of attaching HVAR rockets on F4U. Launching tube is eliminated, as rockets are attached directly to fittings. Here a Naval ordnance man (right) checks circuits before plane takes off. (Wide World photo)

cry, indeed, from the old black gunpowder charges with which designers of liquid-fuel rocket motors contrasted their unit's power. Many solid fuels used today are close behind the liquid fuels in their thermal content. Improved combustion control now enables almost constant thrust outputs to be obtained from large solid-fuel motors for periods approaching those obtainable with liquid-fuel units.

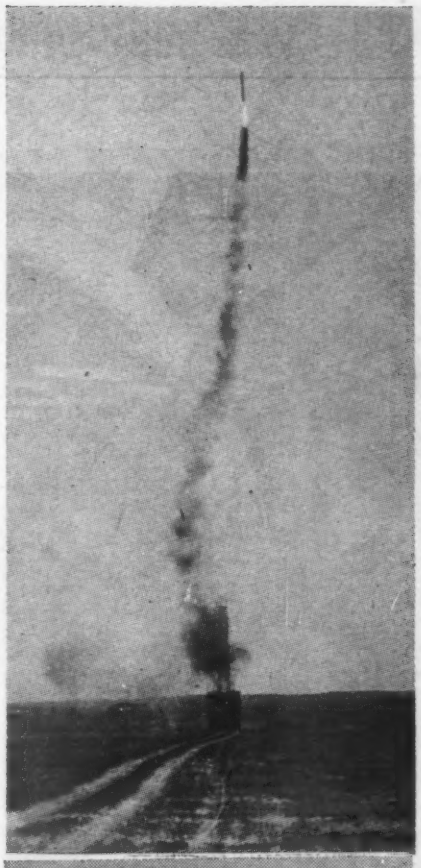
Thermal Jet Power Research

The obvious commercial value of thermal-jet power has already led not only the manufacturers of aircraft engines, but other large industrial organizations such as General Electric and Westinghouse to initiate development programs on this type power plant. Although the gas-turbine-propeller combination now has the advantage of more economical operation, the purely thermal-jet engine, with improved compressors and turbines allowing the use of higher grade fuels and higher combustion chamber pressures, will make the jet as economical as today's reciprocating engines when consideration is taken of the three factors of time, distance, and weight transported.

The thermal-jet motor offers many advantages to the aircraft designer, as was strikingly illustrated in the development of the Lockheed P-80 Shooting Star, where the first model was designed, fabricated, and flown in a period of 143 days (p. 149 July). Elimination of the need for propeller clearances enable aircraft to be built closer to the ground, simplifying landing gear design, enabling servicing and maintenance to be more quickly accomplished, and facilitating loading of passengers and cargo into the aircraft. While replacing the ever-present hazard of whirling propeller blades, the jet engine introduces its own source of danger—the high-velocity heated jet.

The comparative simplicity of jet engine design will cut maintenance costs; and elimination of the complex ignition system, the constant-speed propeller, most of the lubrication system, and many of the present engine instruments, will reduce initial and running costs. Higher cruising speeds, permissible with the greater power of the jet engine, and the cleaner airplane which can be built around this power plant, will result in ultimate reduction of air travel costs.

Other thermal-jet devices, developed along the line of the intermittent firing V-1 motor and the athodyd—which obtains its internal compression before ignition from the dynamic ram pressure of high speed flight—will be vigorously investigated not only for military utilizations but for possible use in highspeed, beam controlled aircraft carrying high priority mail, urgently needed air cargo and other commodities which, since the days of the pony express, have always moved at the fastest possible speed. The liquid-fuel rocket motor may be developed as a competing method of powering special high speed aircraft.

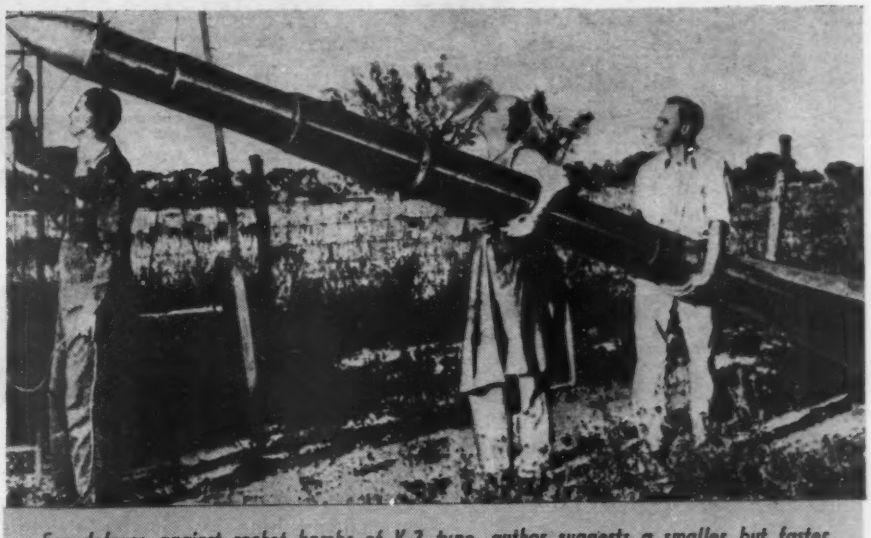


Ascent of aerological sounding rocket designed by Dr. R. H. Goddard. From such prewar private experiments as this, government was able to secure cooperation enabling United States to overtake enemies in rocket development.

With increased emphasis on long range weather forecasting, a more efficient method of gathering data from the higher levels of the atmosphere will be demanded. The aerological sounding rocket, much mentioned goal of rocket experimenters during the past decade, is today a commercial practicability and may eventually replace the present radiosonde balloon. Although liquid fuels were previously accepted as the logical choice for the aerological rocket, recent developments indicate that solid fuel charges may compete even in this field.

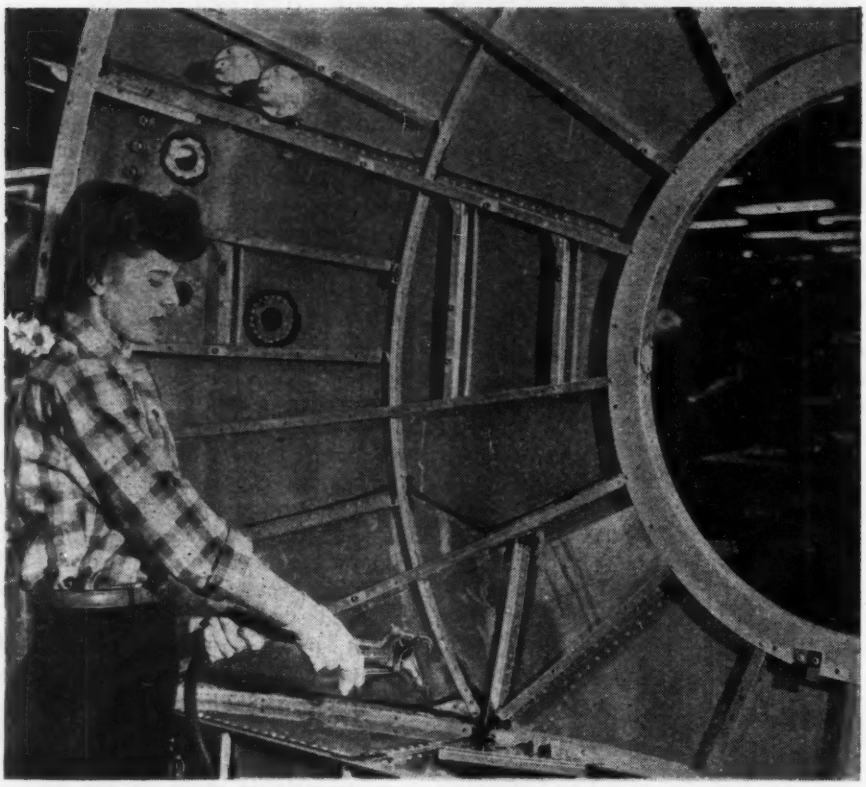
Hyper-Atmospheric Research

With the alcohol-liquid oxygen powered V-2 reaching an altitude of 55-60 mi. there is small reason to doubt the inevitability of rocket exploration of the upper atmosphere at heights of 100 mi. and more. In fact, rumors have it that the Nazis reached an apex of 150 mi. with an experimental model launched straight upward. A projectile of similar design, with controlled acceleration for physiological reasons, and equipped with fast recording instruments, could carry observers into regions as yet untouched by man. Hyper-atmospheric study of the cosmic rays and other phenomena of interest to the scientific world could be conducted under conditions far superior to those existing at a height of 13.7 mi., the present record ascent which was made by Capts. Anderson and Stevens in Nov. 1935. This flight, made under the joint auspices of the Army Air Corps and the National Geographic Society, portends similar civilian-military sponsorship of scientific research in postwar years.



For defense against rocket bombs of V-2 type, author suggests a smaller but faster "hunter" rocket such as this experimental design as offering most immediate promise.

PLANT PRACTICE HIGHLIGHTS

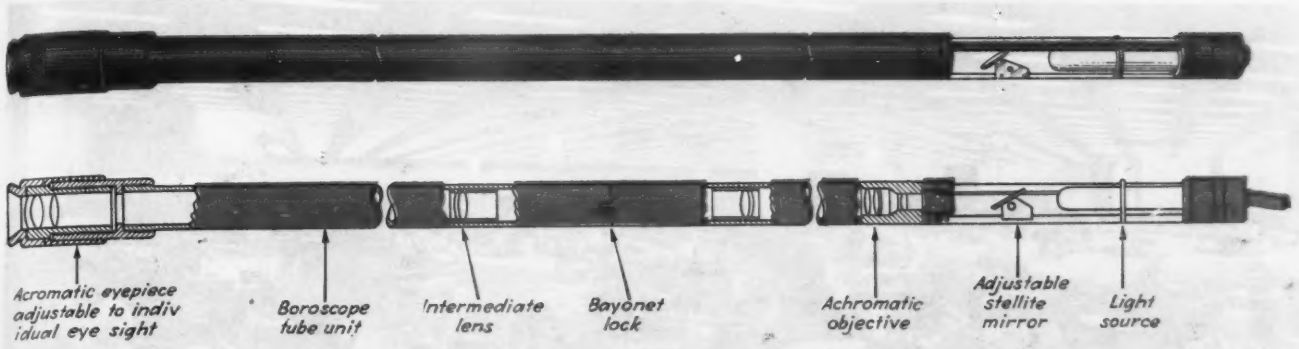


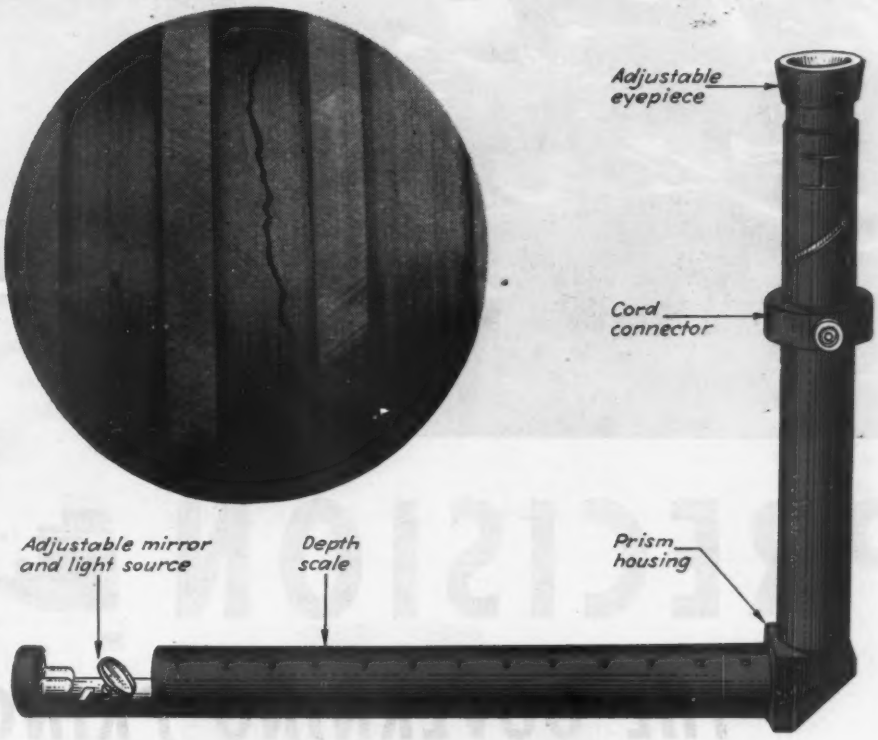
Pressurized Cabin Sealed With Rubber

• By means of flow gun, application of Buna-N to seams and joints of pressurized cabins has been perfected by Chrysler Corp. in building B-29 fuselage sections. Use of pressure gun enables work to be done more effectively and five times faster than by hand application. Sealed by this method, leaking of rivets has been completely eliminated, reports Minneapolis Mining & Mfg. Co., originator of method.

Bulkhead Reworking Expedited By Use of Forming Machine

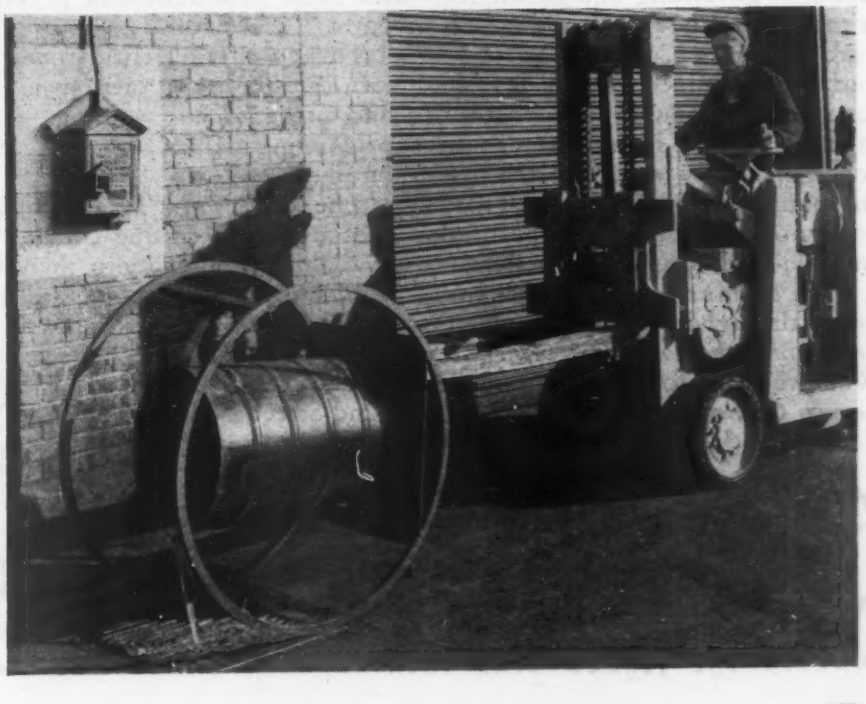
• Troublesome distortion and elongation of work while reworking offsize bulkheads inspired design of this special machine by Curtiss-Wright's Kenmore Div. Consisting of a steel table with scales at edges for measuring alignment, this forming machine is equipped with gear-operated clamps which move in unison, reshaping bulkhead to correct contour without permitting distortion so frequently found when old hand methods were used.





Machinists Now Check Bores With Periscope Device

• Inspection of deep or small bores has been developed to an exact system by use of Borescope, which illuminates and enlarges interior surface, while projecting view of same in eyepiece convenient to inspector. Scale on outside of scope permits close measurement of position of any defect which may be detected. Sketches show two types of device, while photo gives view of interior work as seen in eyepiece.



Roll-Over Waste Container Eliminates Heavy Lifting

• To eliminate use of extra manpower and to expedite handling of plant refuse, Floyd Bliven of General Electric's Erie division, built this rolling attachment for waste cans. Carried by tractor with forked lifting device, drum is dumped by being rolled after tractor lowers it to ground. Low C.G. automatically keeps drum upright, even when filled.

PRECISION

THE GOVERNING PRINCIPLE

WORLD'S largest and oldest exclusive manufacturer of precision governing equipment for prime movers, the 75-year-old Woodward Governor Company of Rockford, Ill., has gained worldwide fame for its development and constant improvement of hydraulic turbine governors. They were also the first company to produce satisfactory governors for Diesel engines and variable-pitch airplane propellers.

Like so many metal working plants throughout the nation where *precision is the governing principle,* Woodward has for many years used *Texaco Cutting and Soluble Oils* to assure the faster machining, better finish and longer tool life essential for mass production of precision parts.

Texaco cutting fluids cool and lubricate the tools, carry away heat and prevent chip welding — thus prolonging tool life, assuring greater output.

The services of a Texaco Engineer specializing in cutting coolants are available through more than 2300 Texaco distributing plants in the 48 States. Get in touch with the nearest one, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

RECONVERSION RUSTPROOFING

5 Points to Remember

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with *official instructions.*
2. Ordnance Specification P.S. 300-4 contains *official instructions* for the complete processing of such equipment.
3. These instructions require that only rustproofing materials meeting Government specifications be used.
4. *Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.*
5. For full information, see your Texaco representative or write to us.

TEXACO REG. T.M.

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT—CBS

Overhaul the Oil Instead of the Engine

How lube-oil clarifier adds great number of flight hours to life of engines, doubling length of overhaul periods through periodical removal of sludge and other impurities.

ACCUMULATION OF SLUDGE in an engine greatly increases wear, clogs the oil cooling system, and upsets the over-all heat balance. Complete sludge removal, performed with sufficient frequency to prevent harmful accumulations, has enabled the engine overhaul period to be extended to as much as twice the normal number of flight hours.

Designed both to filter the oil and to purify it chemically, the Briggs Clarifier operates as a portable auxiliary (Fig. 1). It is attached to the Y-drain of the engine every 25 hr. By means of heated oil, forced through all parts of the engine and oil cooling system, all sludge and other foreign materials are completely removed and then filtered out, while chemical impurities are adsorbed by the filter elements. Oil returned to the engine is, for lubrication purposes, equal to new.

Clarifier consists of a steam boiler, for heating both the oil and filter; pump for oil circulation, with its gasoline engine; and clarifier, (Fig. 2), which is a pressure-tight drum containing 25 cylinders of fullers' earth covered with cellulose (Fig. 3).

Principle on which clarifier operates combines both *ab*sorption of solid matter by cellulose and *ad*sorption of chemical impurities and dissolved sludge by the fullers' earth cylinders forming the main lube-oil clarifying elements.

In use, two circuits (Fig. 4) are employed—first, the oil tank (Fig. 5), then the engine itself. When both circuits have been operated for the specified time (usually about 20 min. for a radial engine), both the oil in the tank and that in the engine are very close to new oil specification, while all parts

Fig. 1. Briggs Clarifier, built as trailer with adjustable front wheel for leveling. At right is drum containing cleaning unit, surrounded by jacket which acts as flue for boiler, contained in left hand section. This part also houses pump and engine with valves and other controls. Fuel tank is at extreme left.

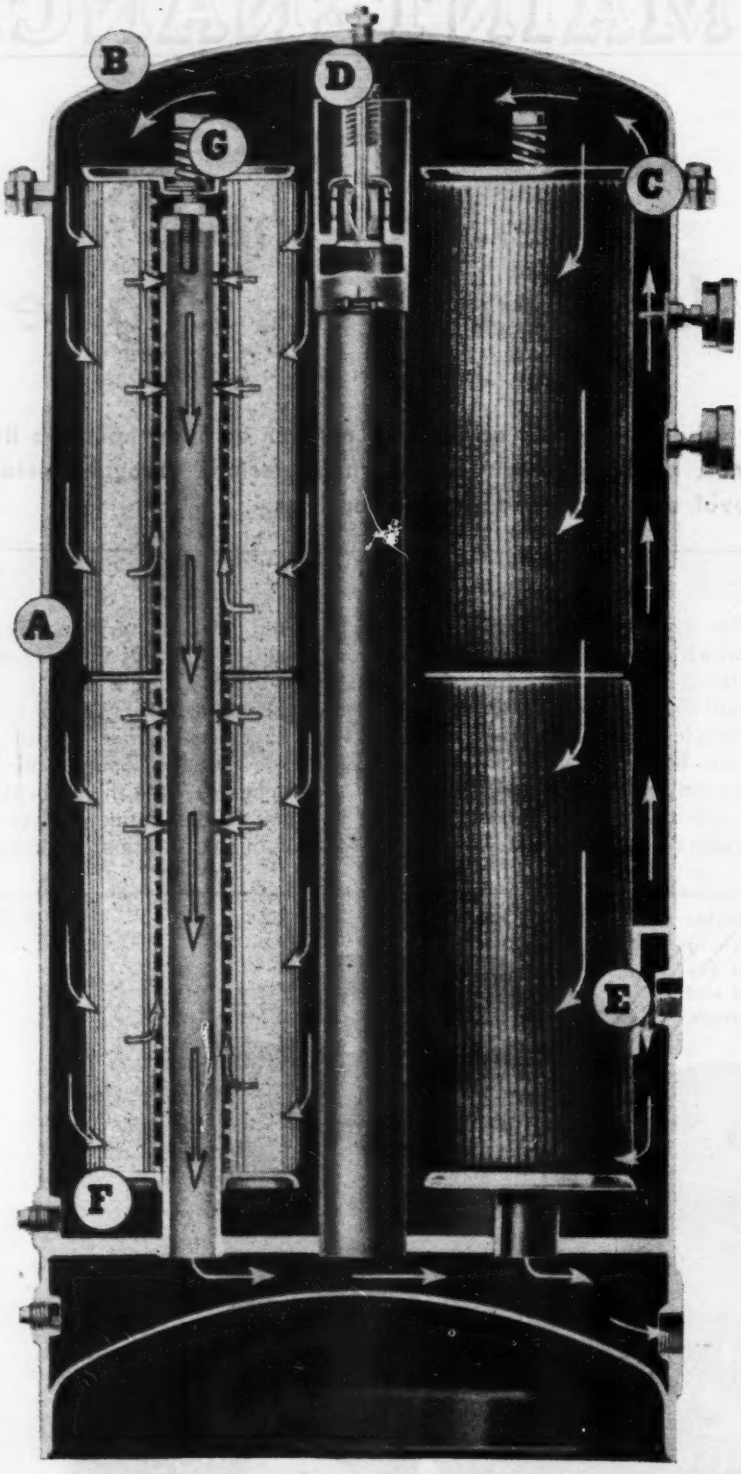


Fig. 2. Clarifier unit has (a) heavy welded steel casing tested to greater than working pressure, (b) detachable cover, (c) cover gaskets, and (d) relief valve which draws off air or gas and maintains pressure differential of 18-20 psi. across cartridge. Baffle plate (e) in front of oil inlet distributes oil evenly among filter cartridges. Sump (f) is for collection of heavy sludge deposited before oil passes through cartridge. Cartridge refill assembly (g) is readily removable by taking out one top bolt.

of the engine, cooler, tank, prop governor, etc., have been thoroughly cleansed.

Results, as reported by AAF, disclose that R-2800 engines which formerly required overhaul every 400 hr. now have had this period extended to 900 hr. Several cases have been recorded where engines went for 1,300 hr, remaining in good condition, and apparently good for several hundred hours more. On disassembly, there was found only the normal amount of sludge which would be present after 50 hr. of running.

Impeller plates, which usually give considerable trouble from sludge, were found to be free, there being no trace of any contaminant. The report credited this condition with the unusual freedom from trouble experienced with this part in the engines.

Cost of operation, based on oil clarification every 25 flight-hours and with labor and supervision at $1 per hour, would be about as follows for one engine:

Clarification (36 operations, 20 min. ea.)	$12
Replacements of filter units at $3 per hr.	36
Cost for 900 flight-hr.	$48

These figures show that the cost of more than doubling the time between engine changes works out to a matter of a few cents per flight-hour—an advantage of considerable importance to both the operating and engineering departments of any organization engaged in air transport.

Fullers' earth, of which the filter elements are made, possesses the property of adsorption, which enables it to remove from the oil and retain dissolved impurities. This characteristic provides a much greater purifying effect than does a means which merely removes solid impurities mechanically, such as a strainer.

Because of this adsorption, it is not practicable to clean out the filter units,

Fig. 3. Top of Clarifier drum shows fullers' earth cartridges in place, with steam-circulating pipes between. Lugs at side are for securing cover.

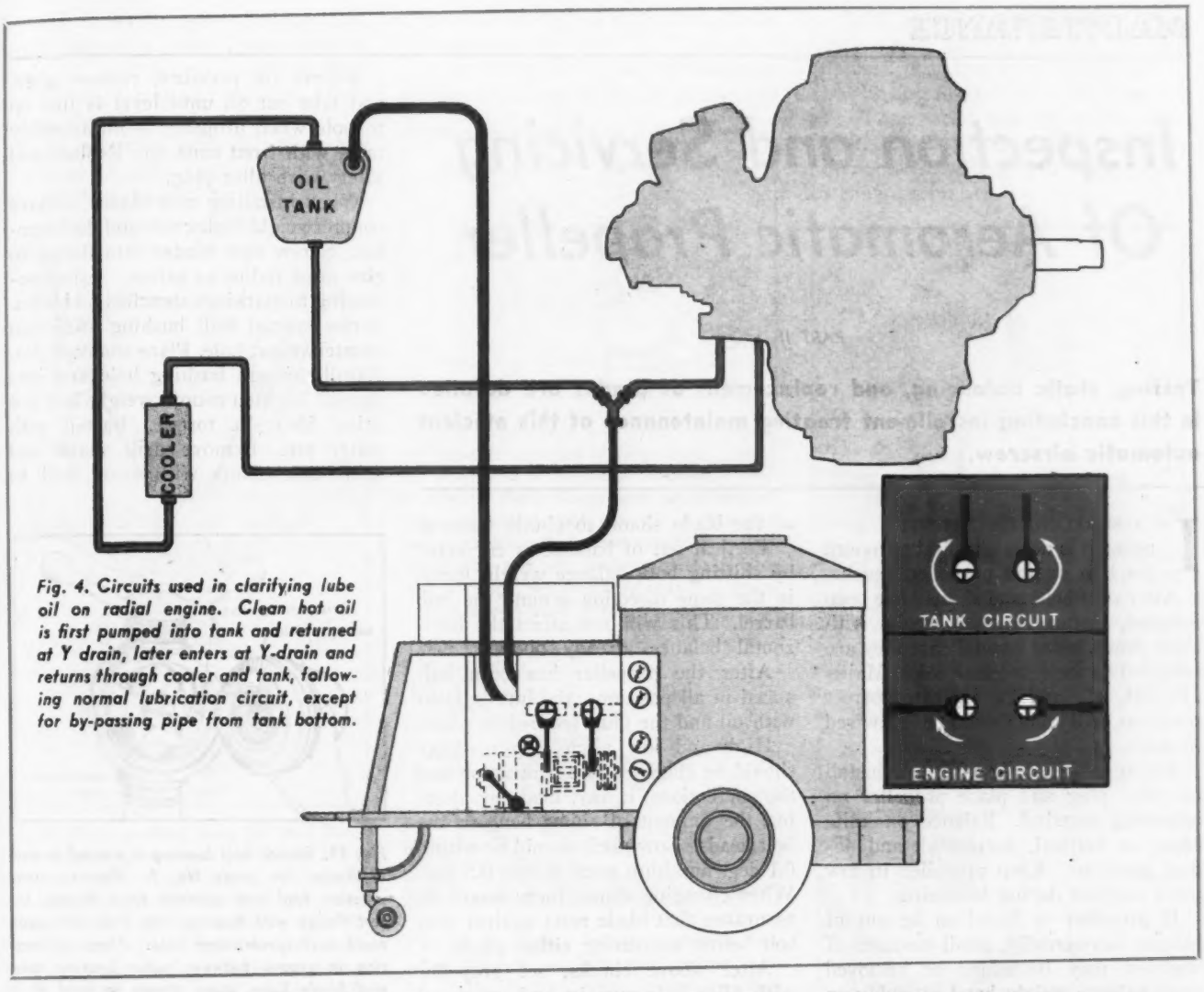


Fig. 4. Circuits used in clarifying lube oil on radial engine. Clean hot oil is first pumped into tank and returned at Y drain, later enters at Y-drain and returns through cooler and tank, following normal lubrication circuit, except for by-passing pipe from tank bottom.

which must be replaced after an average of 50 hr. use. This replacement costs about $3 per hour of use (three engine oil clarifications). Because no oil change is necessary, a saving is realized which has been found to exceed in value the price of the refills.

In the air transportation field, advantages of this equipment—as demonstrated by AAF results—should result in great economies in maintenance. Though the ultimate possibilities in aviation have not yet been gaged, it is of interest to note what has been done in the marine field, where reliability and economy are of as much importance as they are in aviation.

In a specific marine engine having cylinders with 16 in. bore, checked over an operating period totaling 10,540 hr. in 3 yr., bearing and piston ring renewal costs were reduced to $48, as compared to $2,658 in the previous three years when the clarifier was not in use. Due to improved engine efficiency, fuel savings were $4,400 for same period, while cylinder wear was reduced to .0008 in. per 1,000 operating hours as compared to .004 for the same length of time before using the clarifier.

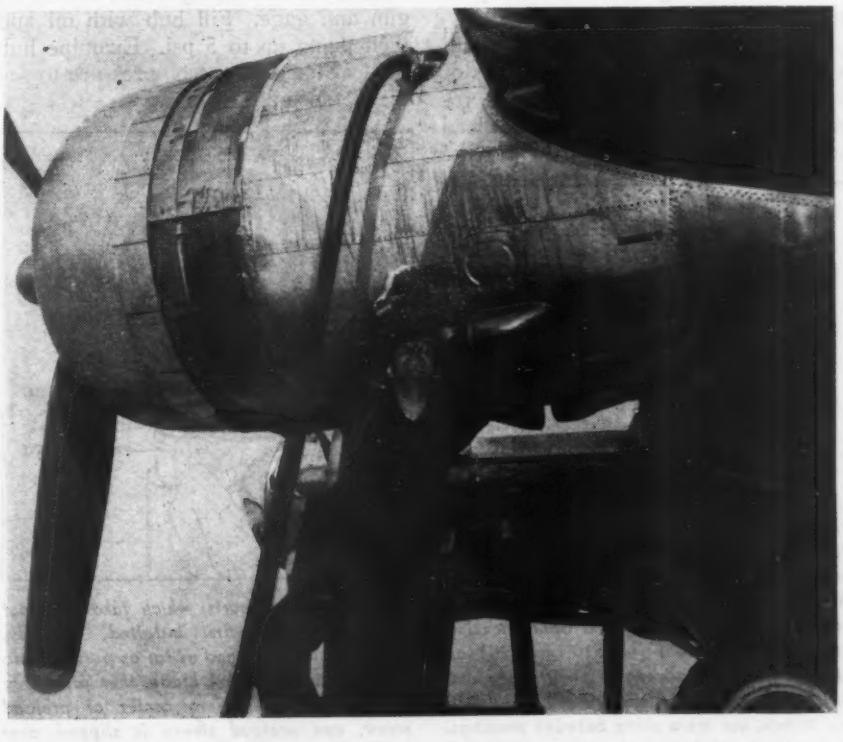


Fig. 5. Demonstrated here is simplicity of connections to radial engine. Tank cleaning circuit is illustrated, with top connection already made and lower being attached by mechanic. Cowling is not disturbed.

Inspection and Servicing Of Aeromatic Propeller

PART II

Testing, static balancing, and replacement of blades are detailed in this concluding installment treating maintenance of this efficient automatic airscrew.

IN ASSEMBLING the Aeromatic propeller it is necessary first to mount the hub on the propeller bench.

After stop bolts and shims have been inserted, install four stop bolts with their shims, being careful that they are returned to their original holes. Marks 1H, 2H, 1L, and 2L indicate correct positions. All bolts should be lockwired in pairs.

Before filling hub with oil, install oil filler plug and place propeller on balancing mandrel. Balance on knife edges in vertical, horizontal, and 45-deg. positions. Keep propeller in low pitch position during balancing.

If propeller is found to be out of balance horizontally, small amounts of washers may be added or removed from balance weight band assembly on hub barrels.

In extreme cases where sufficient weight cannot be handled by means of washers, the heavy blade may be removed and a small amount of lead wool removed from the hollow portion of the blade shank to obtain balance.

Vertical out of balance is corrected by shifting both balance weight bands in the same direction around the hub barrel. This will not affect the horizontal balance already obtained.

After the propeller has been balanced in all positions, the hub is filled with oil and the plug secured in place.

High and low pitch stop readings should be checked with protractor and the corrections, if any, made by altering the amount of shims beneath the bolt heads. Low pitch should be within 0.1 deg. and high pitch within 0.5 deg. When changing shims, there should be assurance that blade rests against stop bolt before measuring either pitch.

After above checks, set propeller with filler hole upright and attach oil gun and gage. Fill hub with oil and then pump up to 5 psi. Examine hub for leakage and watch pressure to see that it does not drop.

Relieve oil pressure, remove gage, and take out oil until level is just up to hole when propeller is on assembly table with front cone up. Replace and safety-wire filler plug.

When installing new blades, remove counterweight lockscrew and disassemble. Screw new blades into flange to give same radius as before. Adjust according to markings stenciled on blades. Screw special drill bushing 2625 into counterweight hole. Place shank of No. 3 drill through bushing hole and into flange. Tighten counterweight bolt nut using 55 ft.-lb. torque. Fasten with cotter pin. Remove drill shank and drill blade shank with same drill to

Fig. 17. Place thrust bearing over flange with large-radius, inside corner next flange shoulder. Place two packings in recess of retainer with grooved sides outwards, and shim between packings. Place retainer and packing on thrust bearing and apply packing compression test tool (No. 10, Fig. 26) on top. Clearance between retainer plate and bearing should be between 0.010 and 0.015 in. If less, use more shims between packings. If retainer will hold only one packing, all shims must be added before packing is set in place.

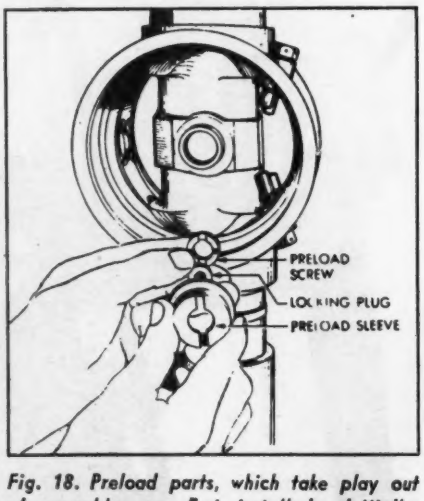


Fig. 18. Preload parts, which take play out of assembly, are first installed. Initially, preload screw is turned as far as possible into bearing stub for No. 1 blade, then pipe plug is screwed loosely into center of preload screw, and preload sleeve is slipped over stub. Pipe plug is for locking preload screw by expansion after adjustment of sleeve carrying radial ball bearing.

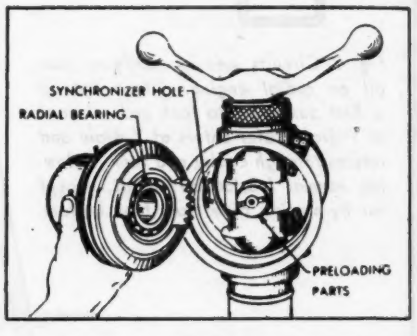


Fig. 19. Radial ball bearing is placed in end of flange for blade No. 1. Remove compression tool and retainer from flange. Insert flange with bearing into hub with gear teeth next synchronizer hole. Place oil seal ring in groove between outer bearing race and blade bore, using grease to hold it in place. Then place retainer (with its packing rings) on flange, with grooved side of packing outward.

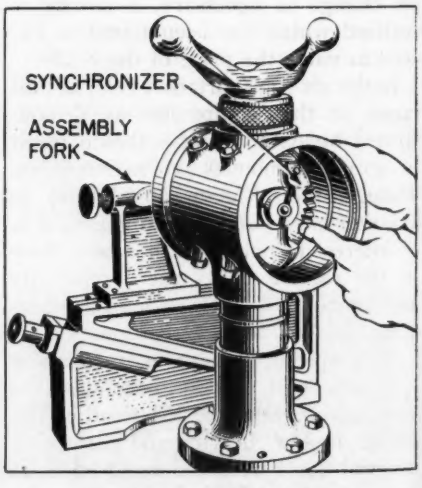


Fig. 20. Attach assembly fork (Tool No. 5, Fig. 26) to flange No. 1. Hold synchronizing gear in place and mesh with teeth on flange. Insert and fasten synchronizer shaft and its parts, then secure them in place, making sure that correct shims have been used. Blade No. 2 is correctly meshed by holding both blades against high pitch stop bolts.

depth of $\frac{1}{16}$ in. Remove drill bushing, install lockscrew, and safety-wire it. Drain oil from propeller and balance. Small changes may be made with washers, as already noted.

Refill propeller with oil, then test on engine. Engine rpm. on ground, at full throttle, should be as specified. Otherwise low pitch stop bolts should be adjusted.

After low pitch has been pronounced satisfactory, engine should be checked in flight at full throttle, and specified rpm. Slight changes in rpm. may be obtained by adding to or removing thin disks under nut on crankshaft end of bolt. Removal of disk $2\frac{1}{4}$ in. dia. x $\frac{1}{32}$ in. thick, will add about 50 rpm., while adding same weight will reduce rpm. by same amount.

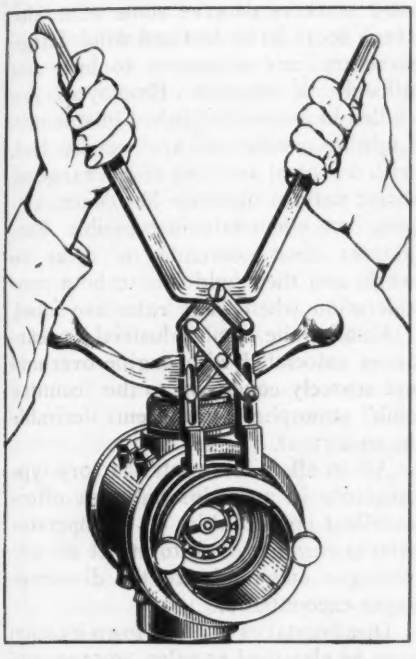


Fig. 21. Place packing assembly tool No. 9 over flange. Insert retainer snap ring in hub bore and adjust thumb screws of assembly tool until packing retainer rests firmly against bearing. Use snap ring assembly tool No. 9 to contract ring and fit it into hub groove. Insert preloading tool No. 8 through hole in flange and turn to left until all flange play is removed. Tighten further to preload bearing slightly. Then hold in that position, while tightening plug which locks preload screw. Check locking action by trying to turn preload screw inward. If not tight, preload again and relock, testing as before. Measure backlash of gears with protractor. This should not be more than 1 deg.

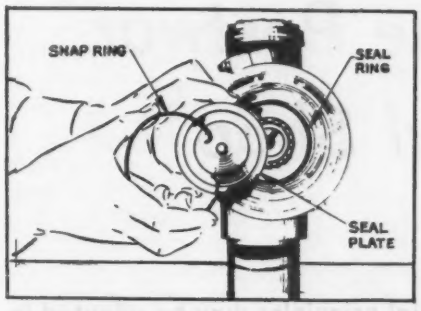


Fig. 22. Coat flange seal ring with grease and place in inner end of flange bore, stretching it slightly, if necessary, to make it stay in place. Place flange seal plate against ring and attach tool No. 12, compressing seal ring sufficiently to clear snap ring groove. Insert snap ring with both prongs on leading side of flange, reaching in to snap it in place. Repeat operation in flange No. 2.

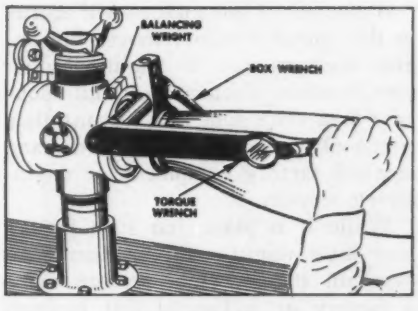


Fig. 24. If balance weight assemblies have been removed, replace and tighten with 55 ft.-lb. torque. After assembling both flanges, screw blades into flanges, using blade wrench No. 1. Never screw blades into flanges without first using anti-seize or a mixture of 70% white lead and 30% engine oil. Before blades are clamped into position, use assembly fork to lock flange in center position. Phase angle is measured in same manner as before disassembly.

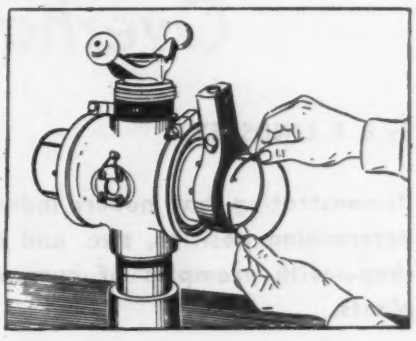


Fig. 23. Lubricate counterweight bolt threads with anti-seize. Place counterweight sufficiently far back on flange to permit snap ring to be installed, then move counterweight over snap ring. Threaded end of weight bolt should be toward hub with largest weight next arm. Insert lubricated clamp bolt in arm and turn nut on loosely.

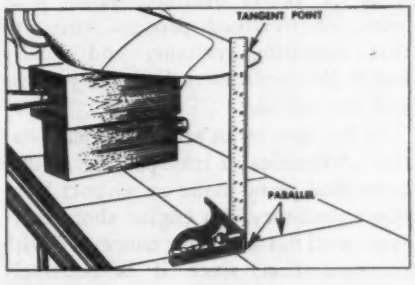
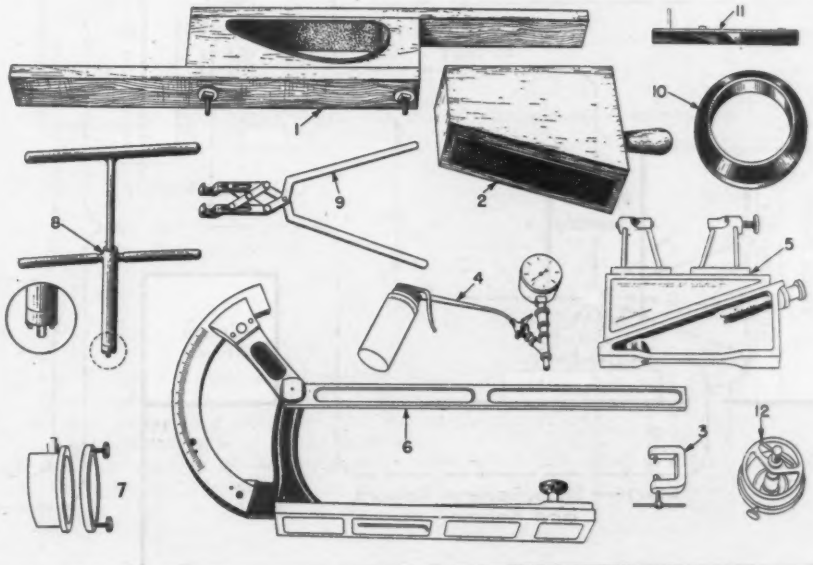


Fig. 25. To check tracking of blades they are supported by blocks to prevent turning, and greatest dia. is brought against a square on bench center line. Square is then moved to opposite blade end and is placed in bench center line to check alignment of blade center which should be within 1/16 in.

Fig. 26. Here are special tools for servicing Aeromatic propellers: (1) is blade wrench, (2) block for holding blades in steady position, (3) counterweight spreader, (4) oil gun and detachable pressure gage, (5) assembly fork for fixing position of flanges for angular measurements, (6) protractor for measuring blade and counterweight angles, (7) packing assembly tool for holding packing in place, (8) preloading tool for simultaneously handling preload screw and pipe plug which locks it, (9) retainer snap ring assembly tool for compressing snap rings (10) packing compression test tool for determining flange packing clearance, (11) protractor adapter for use with protractor in measuring angles of curved blade surfaces, and (12) flange seal ring assembly tool used for compressing seal rings while assembling snap rings. (Aero Manuscripts photo)



Planning the Postwar Overhaul Shop

By E. F. LINDSLEY

Demonstrating that modern industrial principles may be adopted in determining position, size, and equipment of the engine overhaul shop—with examples of currently successful medium and small plants.

SHOP LOCATION AND LAYOUT are of fundamental importance to anyone operating or contemplating the operation of an overhaul business. The keynote, as mentioned previously, is this: Decide upon the shop's market scope or yearly overhaul quota, then select an overhaul process suited to that operating volume, and finally *match the facilities to both the process and the volume.*

In the case of an airplane repair station, difficulties of transporting a fully assembled plane make an airport location mandatory. An engine shop, however, need not be overly concerned with transportation, since it is relatively easy to swing an engine from an airplane into a truck.

A number of advantages will accrue to the operator who removes his engine overhaul from its traditional airport location. Factory overhaul shops have long since done this, because they commonly take in jobs that demand original factory equipment or engineering service.

While it is plain that such factors have little weight in the location of an overhaul station, other reasons make a factory or industrial loft location worth consideration: Accessibility to rail and truck terminals; easily tapped power, water, and sewage facilities; lowered rentals and taxes; and better fire protection and lowered insurance rates.

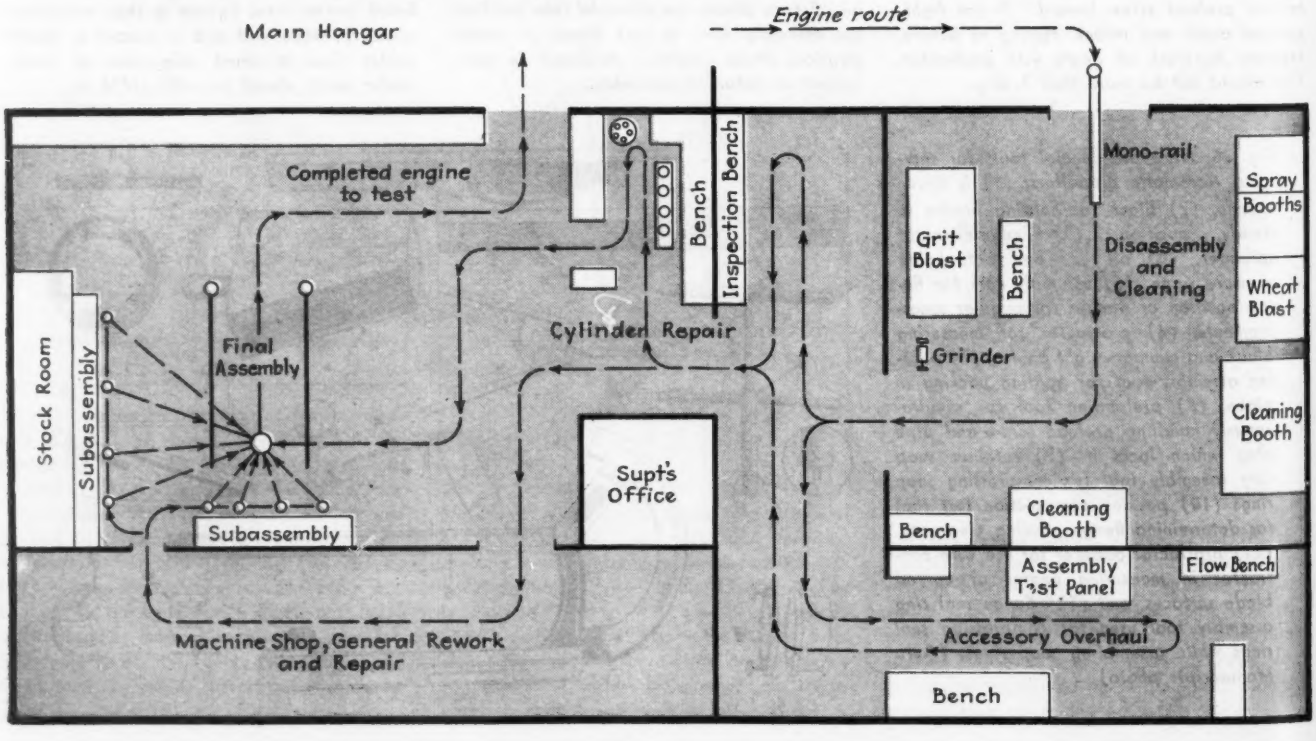
The convenience and comfort of the shop workers deserve some attention. Huge doors let in dust and wind. Large structures are expensive to heat and difficult to insulate. Employees are chilled in winter and baked in summer. Lighting conditions are usually bad, with a central area out of the range of direct natural lighting. Moreover, airports are commonly inaccessible. Employees must commute or drive to work, and they hold this to be a consideration when wage rates are fixed.

Finally, the semi-industrial appearances associated with engine overhaul are scarcely conducive to the "country club" atmosphere that seems desirable in an airport.

All in all, a low-rental factory-type structure in an industrial area offers excellent opportunities to the operator who is clever enough to utilize the advantages and minimize the disadvantages encountered.

Disadvantages of an in-town location may be classified as sales, storage, and noise problems. An operator who shunned the airport completely would soon lose contact with his customers. An office and line service facility at the field would help maintain overhaul sales and keep the company's name before the eyes of itinerant flyers.

Fig. 1. Typical small airline shop, showing flow of engine parts and accessories with compact yet segregated departmental layout. Lost motion is reduced to a minimum by careful planning.



It would probably be quite easy to find a location where engine test noise would be no greater than other industrial noises in that area; in some localities, however, a baffled test-cell arrangement would be required to prevent residents from petitioning to get the repair station out of their area.

But if the operator intends to draw his business from local sources, or from airplanes flown into the field, or if airplane repair is engaged in, provision must be made to store the planes while the work is being done, which would mean the rental or ownership of airport hangar facilities.

Here there is room for clever business management. Eventually, some operator is going to provide a fast-moving parts exchange service. A customer will not have to lay up his plane while the shop makes repairs. Instead, the customer will bring in his plane, ask for an exchange engine installation, or for that matter, a new wing panel, tail surface, or landing gear unit, and within a few hours fly away. Damaged or worn units will be repaired and stocked for the next customer. Prices will be fairly high, to take care of the money tied up in parts inventories, but the customer will not suffer the delays now common to private aircraft service.

It should not take a pair of skilful mechanics more than two hours to change the average light engine installation. Few repairs, except for a major rebuilding, should require over a day or two in the hangar. By working out such a plan, the operator might avail himself of a fairly large factory building, away from the airport.

While a small but carefully selected crew, handling both parts exchange and line service, acts as the "meet the public" section of the organization, the main engine and airplane repair stations would function under ideal working conditions in the factory. Personnel could go about the task of overhauling exchange units without constant interruptions for minor line service.

This last condition can be a very expensive item for a small shop. Large and profitable jobs are too frequently delayed while a mechanic attends to a small profit, or even a "no charge" task for an itinerant customer. This idea might be carried to a logical conclusion wherein the operator established himself on a retail basis to local customers, and also served as a jobber of exchange parts for other repair facilities scattered over a wide area. His central repair station could utilize machinery and obtain economies impossible for any one of the series of small airport shops making up the independent retail outlets.

When the overhaul operator has made the decision as to the location of his business, he must apply his talents to the layout. There are two schools of thought on this subject. One group insists that the most logical plan consists of detailing of the overhaul process down to the last machine and stock bin, and then either building or renting a structure that fits this process exactly. The other school holds with the idea of plotting a general layout of the overhaul process, and then adapting that plan to the best available structure.

The first plan offers the very finest shop when completed, but it also requires no lack of capital. If a building is constructed to satisfy a pre-planned overhaul process in all minor details, it goes without saying that a great amount of forethought must go into the planning. Minor slips in the original plan may bring about an inflexible structure with unanticipated and hard-to-remedy flaws. In addition, it is often quite difficult to remodel the structure to fit changes in procedure.

With some industries, processes are fairly well frozen, and a carefully planned functional structure will serve faithfully until it has paid for itself. In aviation, however, change seems to be the custom, and the most intelligently designed structure may become obsolete in a few years. Again, consideration should be given to the possibilities of selling the building at a future date. Buildings constructed to match a highly specialized process are frequently very hard to sell.

The second plan, which fits a general functional pattern into a fairly

(*Turn to page* 256)

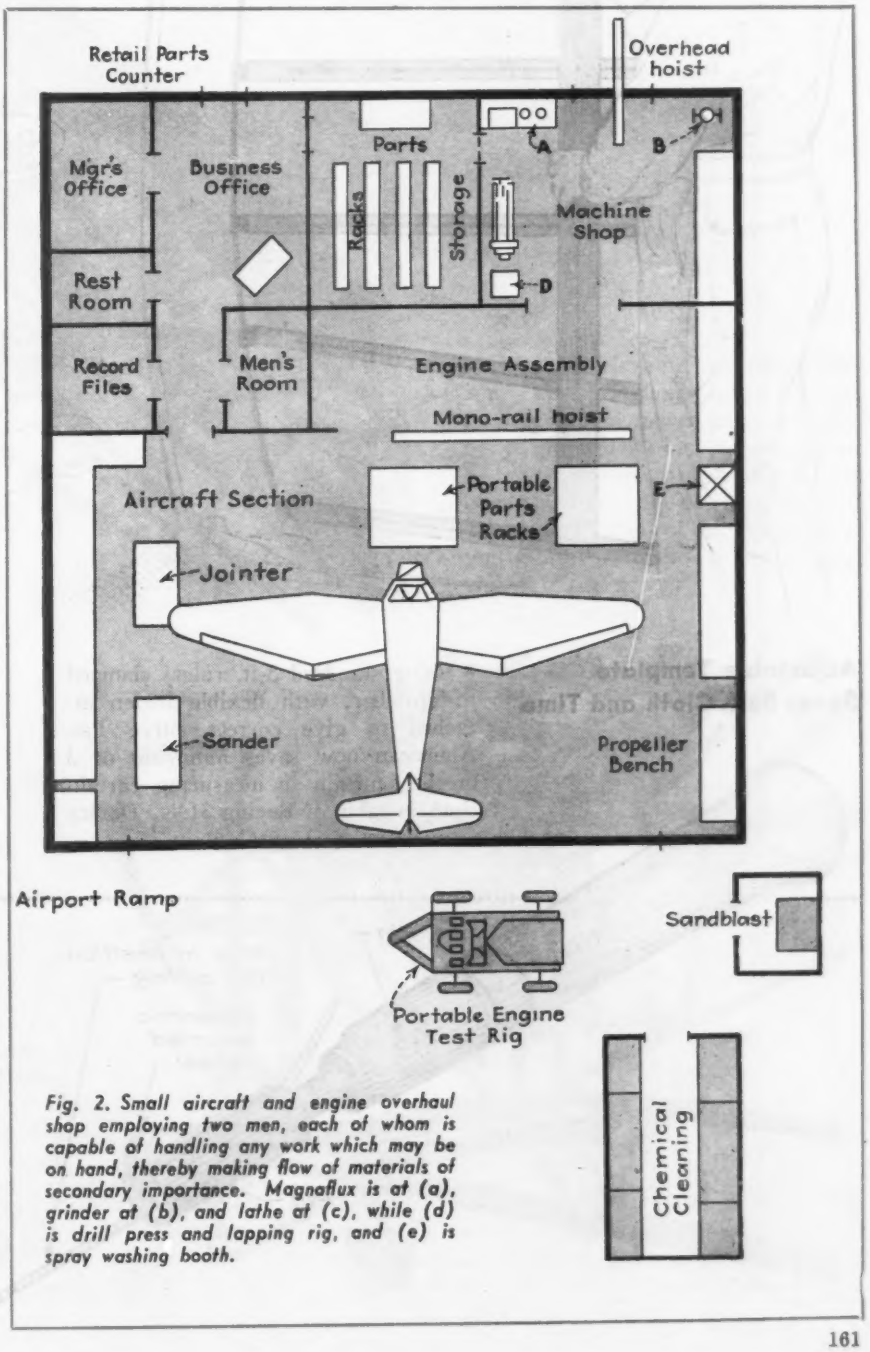
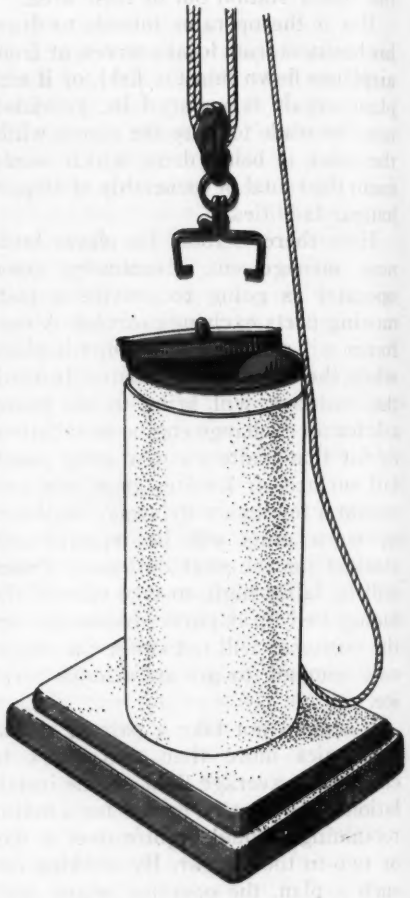


Fig. 2. Small aircraft and engine overhaul shop employing two men, each of whom is capable of handling any work which may be on hand, thereby making flow of materials of secondary importance. Magnaflux is at (a), grinder at (b), and lathe at (c), while (d) is drill press and lapping rig, and (e) is spray washing booth.

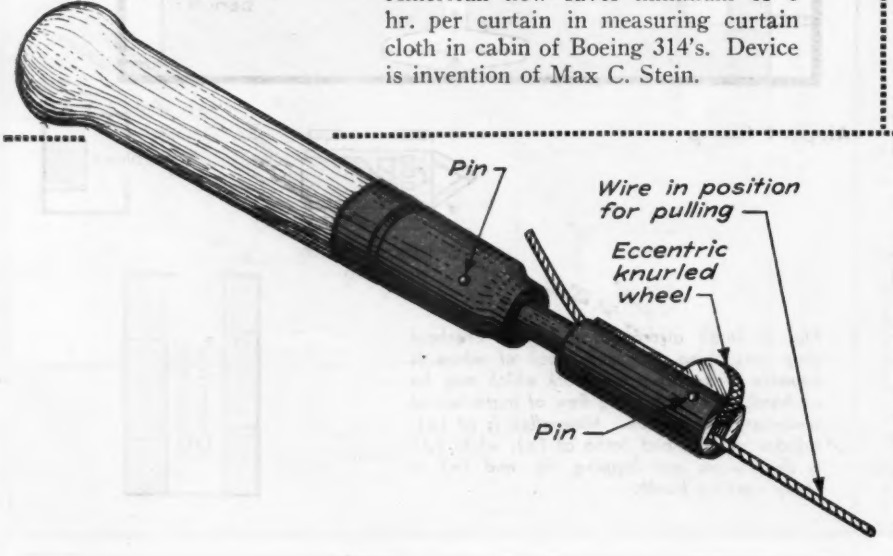
Adjustable Template Saves Both Cloth and Time

• Using standard 3-ft. rulers clamped to crossbar, with flexible batten attached to give correct curve Pan American now saves minimum of 3 hr. per curtain in measuring curtain cloth in cabin of Boeing 314's. Device is invention of Max C. Stein.



Hot Bath Removes Prop Tipping

• To remove rubber tipping from propeller blades, UAL uses vertical, tubular tank, buried 4 ft. in ground. Filled with water and heated by steam introduced at bottom, tank enables rubber strips to be removed after 5 min. soaking. Outside of tank is asbestos-covered above floor level, and special grip is provided for handling blades while in hot water.

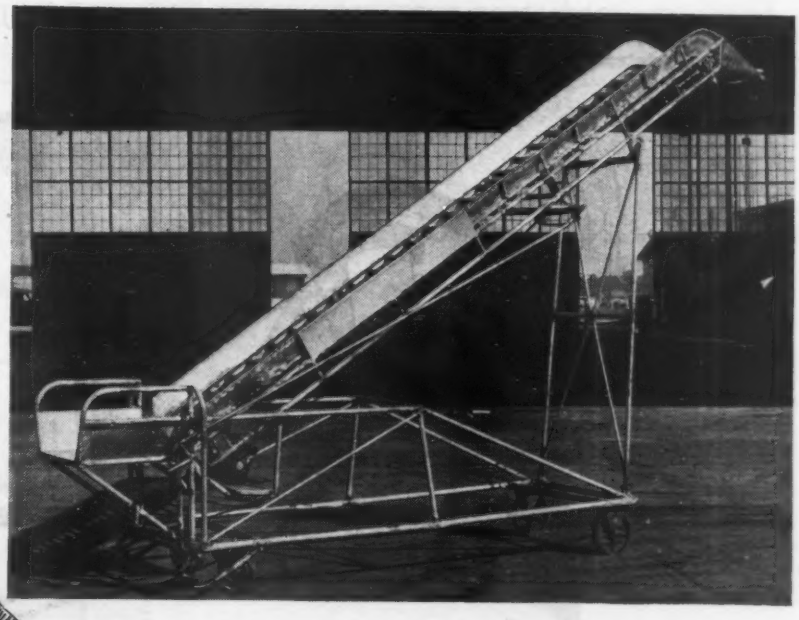


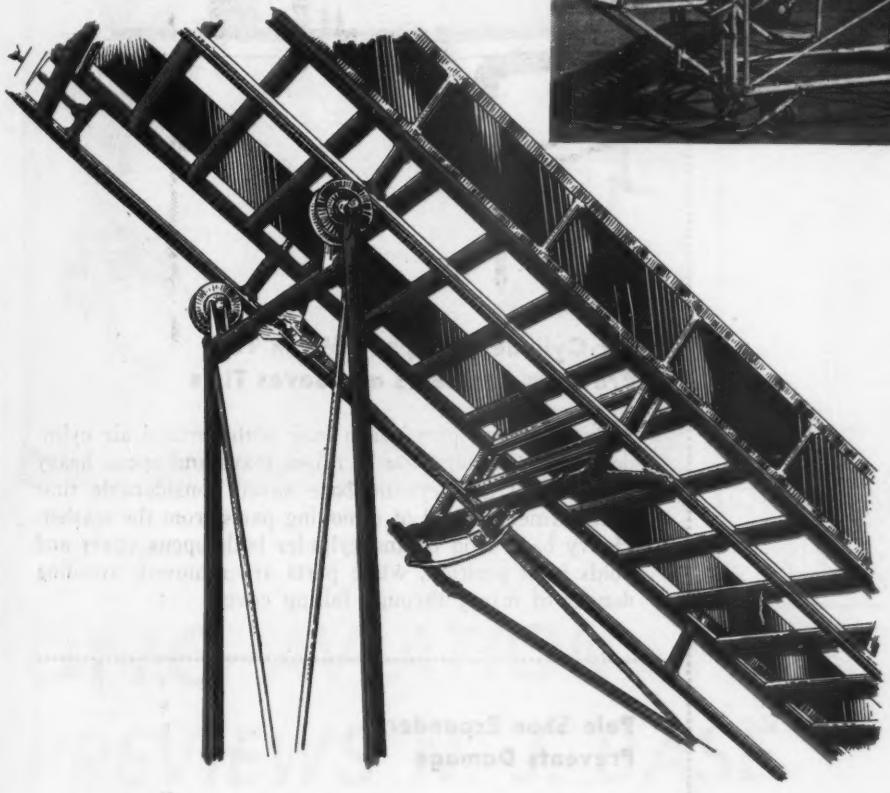
Cable Handler Grips Automatically

• To tighten cables and small wire without danger to hands, G-E mechanic made this grip by placing a small, eccentric, knurled wheel on end of worn-out screwdriver shank. Knurling not only gives non-slipping qualities but enables wire to be released by finger motion.

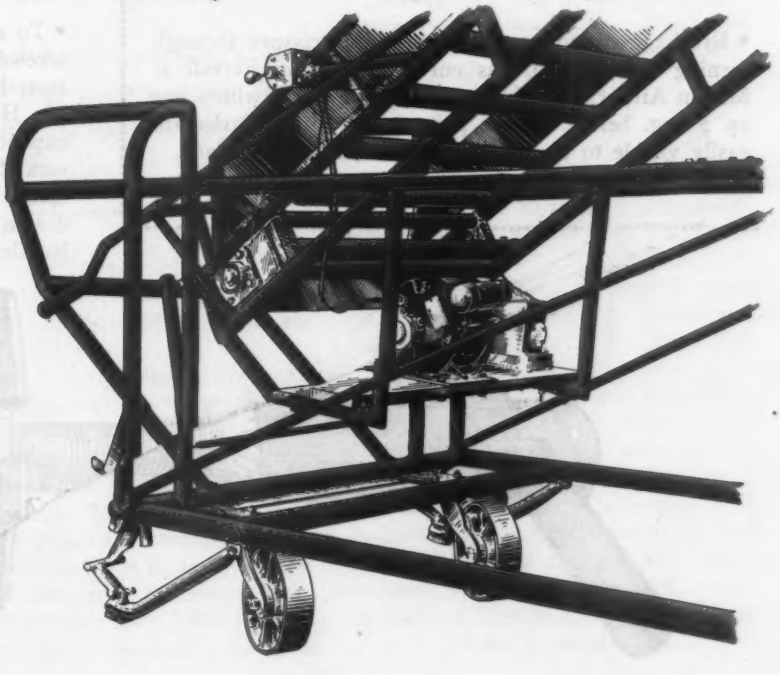
This Adjustable Elevator Loads Freight Quickly

• To accommodate different heights of loading doors in airliners, C & S maintenance shops built this adjustable self-acting package elevator. Frame is of welded steel tubing, with elevator hinged at lower end and supported near top by swinging tube brace provided with pulleys which bear against elevator lower frame. Crank used for raising elevator runs along side of frame.

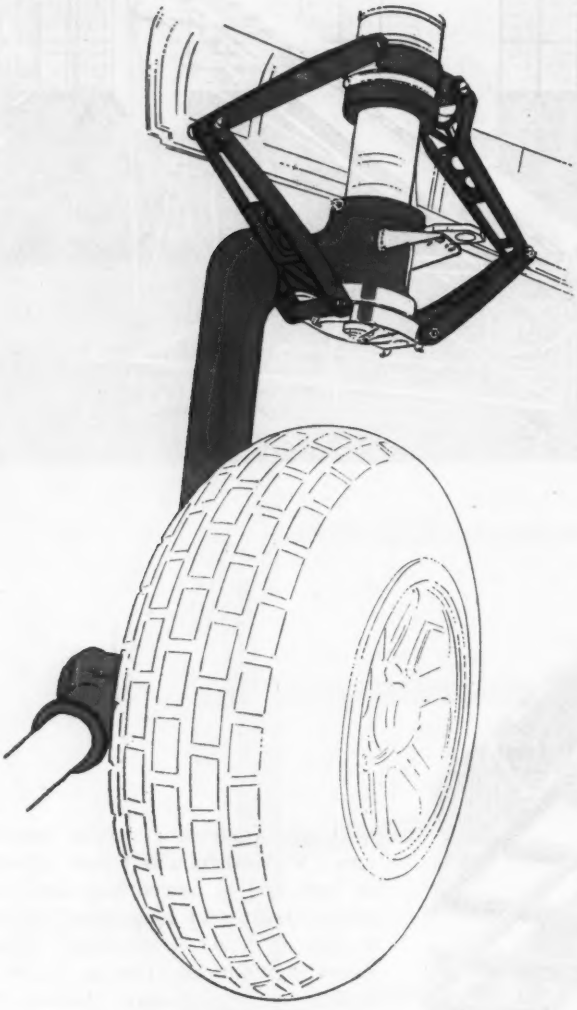




Detail of elevator raising mechanism. Vertical tubular frame is hinged at base and is moved back and forth under elevator by long screw attached to hinged center of crossbar. Chain-operating nut on raising screw is driven by jointed shaft (bottom center) which runs down to righthand side of operator.

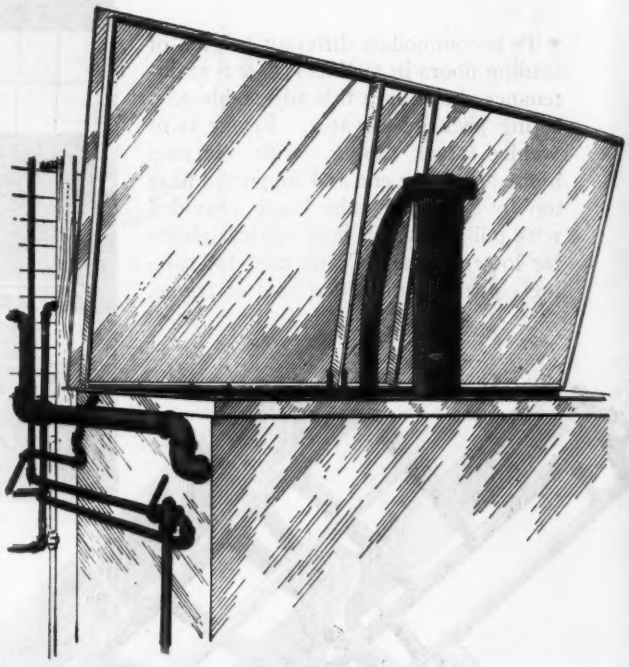


Wheels at lower end swivel to permit aligning with plane. Machine is locked firmly in place when operating by means of hinged shoes to left of wheels. Hand crank for raising is at left of guard rail. Reversible motor and gearbox are under lower end of elevator with reversing switch abo[illegible]ine close to operator's hand. This [illegible]as fast will handle baggage or fre[illegible] as two men can load it



Painted Stop-Marks Curb Landing Strut Damage

• Breakage of nose wheel stops and scissors through turning too sharply was cured by Venton Ferrell at Martin Airport by painting bright red marks which line up 5 deg. before danger point in turning. Marks are easily visible to tractor operator when towing plane.

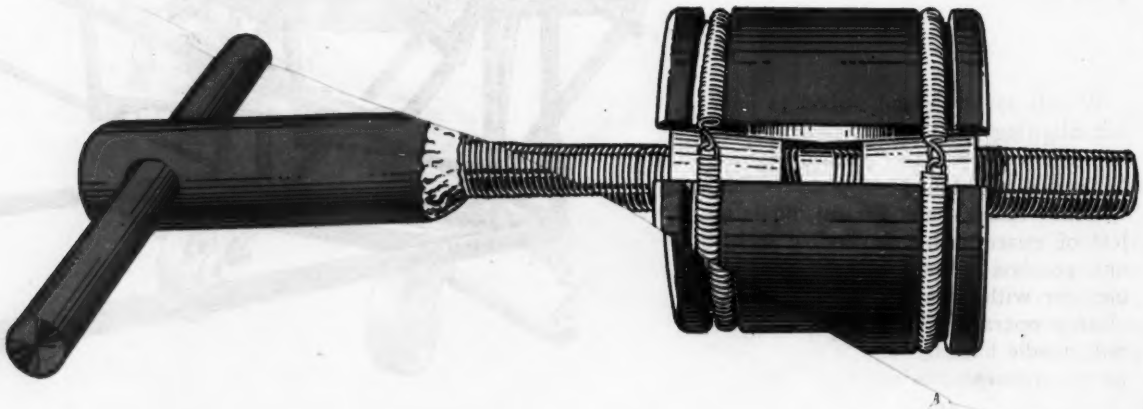


Air-Cylinder Equipped Wash Tank Prevents Accidents and Saves Time

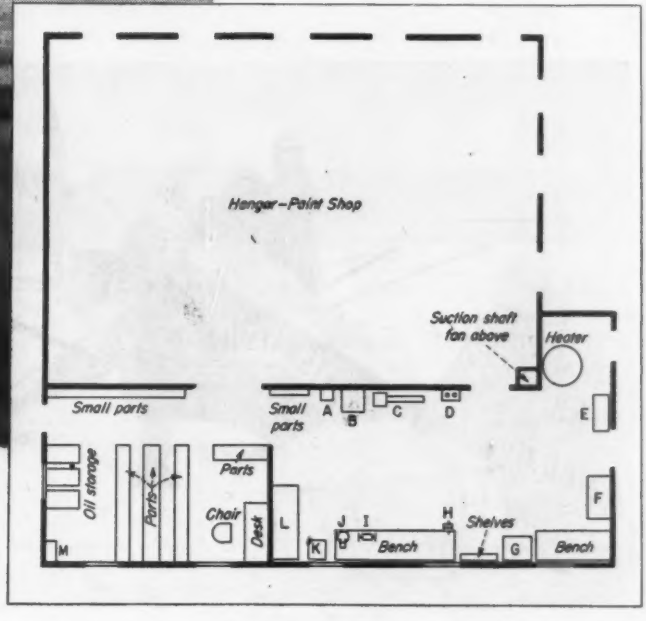
• By equipping parts wash tank with vertical air cylinder, which simultaneously raises trays and opens heavy cover, UAL's Cheyenne base saved considerable time over former method of removing parts from the washer. Heavy band iron behind cylinder both opens cover and holds it in position, while parts are removed, avoiding danger of injury through falling cover.

Pole Shoe Expander Prevents Damage

• To avoid damage to pole shoes, which occurred when screwdriver was used to force them in place when assembling starter motors, Sgts. J. W. Turner and L. M. Holmes of USA ASC (England) devised this expander which forces shoes into position without scratches or damage. Semi-circular halves are forced apart, against pole shoes, by wedge-shaped center pieces, drawn together by right- and left-hand screw thread on handle. Resulting time saved was seven days in eight.



Flyer's-eye view of Otto Aviation's Lake Susquehanna base shows placement of hangars, parking space for planes, and portion of landing field. At left is main hangar which also houses office and ground school, while at right maintenance hangar can be seen. Note tennis court at upper left.



Shop layout at new base shows: (a) Drill press, (b) table saw, (c) lathe, (d) welding equipment, (e) air compressor, (f) portable parts washer, (g) portable parts rack, (h) vise, (i) tool grinder and wire brush, (j) arbor press, (k) Magnaflux inspector, (l) Magnaflux washer, and (m) battery charger.

OTTO AVIATION PREVIEWS N. J. BASE

Lake Susquehanna Airport, opened as fixed base operator's new headquarters, houses school and overhaul and maintenance shop, also serves as terminal for subsidiary airline. Shop features lineup of practical facilities for reconditioning craft.

SITED AT BLAIRSTOWN, N. J., twelve miles northeast of the Delaware Water Gap, Lake Susquehanna Airport, new operations base of Otto Aviation, Inc., was recently opened in an inaugural which afforded what may be a preview of the healthy business potentials awaiting fixed base operators in postwar aviation.

Started almost from scratch a year ago, the airport has been completely rebuilt into a model base housing a ground and flight school and an overhaul and service shop. The port also serves as a terminal point for the company's newly inaugurated passenger route between North New Jersey, the New York City metropolitan area, and Atlantic City.

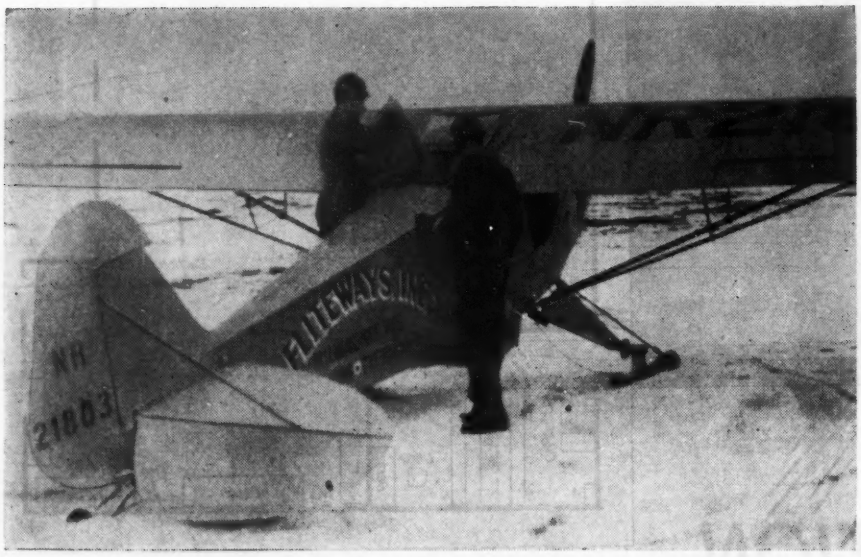
Although present facilities are stated to be complete enough to handle current business, further expansion is planned when more materials and equipment become available.

Susquehanna Airport has a main hangar (in which the operations office and ground school are located), a service hangar containing the shops, and a landing area more than 2,000 ft. long, with about that same length in additional clear space beyond the field's boundaries, free of trees or other major obstructions. And within very short walking distance of the airport there is a resort-hotel with all types of recreational facilities available (latter was described on page 190 May 1944 AVIATION).

A fleet of Aeroncas and Piper Cubs are used for student instruction and also by licensed pilots who wish to keep up their flying time. The Aeroncas, which were formerly surplus AAF 0-58B's, were reconditioned at the base by Otto Aviation and are now almost identical to the Aeronca TAC model. In addition there is a Waco UPF-7 for

(*Turn to page* 245)

DUST CROPS AND REAP PROFITS



Fitted with skis for use on snow, this Cub is used for distributing fertilizer on top of snow. This is an excellent example of winter operation in a section where flyers usually den-up until Spring. (Fliteways photo)

BECAUSE, UNIQUELY, it is a major agricultural implement which never physically touches the field on which it is working, yet alone can handle broad areas in jig time, the dusting airplane affords notable advantages over former restricted-contact methods of performing many tasks.

From spreading fertilizer, through weed control and seeding to insect pest killing, utilization of the airplane has not only brought down the cost of farming but has in many instances permitted the raising of paying groups in a volume which would otherwise have been impossible.

In addition to the regular farming operations just mentioned, the parallel operation of forestry has benefited through more complete pest control by means of insecticides dusted from the air.

Fruit growers have discovered that orchards can be protected by use of the airplane much more efficiently than from the ground.

From the foregoing statements it might be imagined that anyone who has engaged in farming could immediately make far greater profits if he were to purchase and use an airplane in his work. This is, unfortunately, far from being the case. There are difficulties and disadvantages which should be carefully considered before attempting to use an airplane for farming.

First of all, consider the difficulties: The legal aspect is one which confronts everyone who goes in for crop dusting.

Table I—List of Materials

Hopper Unit

1	72 in. x 36 in. x .039 in.	2SO sheet aluminum
2	60 in. x 36 in. x .065 in.	2SO sheet aluminum
2	72 in. x 36 in. x .065 in.	2SO sheet aluminum
2	48 in. x 36 in. x .065 in.	2SO sheet aluminum
1	36 in. x 38 in. x .065 in.	2SO sheet aluminum
1	20 ft. x 1⅛ in. x 1/8 in.	aluminum alloy T section
2	20 ft. x 1½ in. x 1/8 in.	aluminum alloy angle
1	6 ft. x 1 in.	aluminum hinge
2	12 ft. x 2½ in. x .091 in.	2S 1/2H aluminum alloy sheet
1	15 ft. x 1/2 in.	aluminum channel
660	1/2 in. #8–32 cadmium-plated bolts and nuts	
200	3/4 in. #10–32 cadmium-plated bolts and nuts	
1	25 ft. of 3/4 in. channel rubber edging	
3	Automobile hood hooks or trunk latches	

Conveyor Unit

1	27 in. x 9 in. x 3/16 in.	aluminum alloy plate
1	48 in. x 48 in. x .065 in.	2SO sheet aluminum
4	10 ft. x 1¼ in. x 1¼ in. x 1/8 in.	aluminum alloy angle
1	24 in. x 26 in. x .091 in.	2S 1/2H sheet aluminum alloy
2	12 ft. x 1 in. x 1/2 in. x 1/8 in.	aluminum alloy angle
4	8-tooth #32 sprockets	
1	10 ft. #32 malleable detachable chain	
40	A-1 attachments for # 32 chain (20 for R, 20 for L)	
5	3/4 in. rubber pillow block ball bearing	
4	#3 tapered pins	
50	3/16 in. x 3/4 in. aircraft bolts and castle nuts	
30	3/16 in. x 1 in. aircraft bolts and castle nuts	
1	3 in. x 26 in. x 3/16 in.	aluminum alloy plate
200	#10–32s cadmium-plated bolts and nuts	
1	30 in. x 3/4 in. O.D. x 3/32 in. wall aircraft tubing	
1	44 in. x 3/4 in. O.D. cold-rolled shafting	

Power Unit

1	48 : 1 gear reducer
1	18 dia. wood propeller; 2 blade
1	12 ft. x 3/16 in. flexible cable
1	3 ft. x 1 in. x 3/32 in. molybdenum steel
1	Stub shaft to hold propeller on gear box drive
1	4 in. x 1 in. flat pulley for brake drum
1	12 in. x 1 in. steel brake band
1	12 in. x 1 in. brake lining
1	12 ft. x 1½ in. x .035 in. streamlined seamless steel aircraft tubing.
1	3/16 in. plate 6 in. x 6 in. to hold brake assembly
4	1/2 in. x 1½ in. bolts and nuts
1	12-tooth sprocket #41—7/8 in. bore
1	24-tooth sprocket #41—3/4 in. bore
1	45-tooth sprocket #41—3/4 in. bore
1	6 ft. #41 roller chain
1	Half link for #41 roller chain
1	Connecting link for #41 roller chain

Venturi Tube and Control

1	24 in. x 26 in. x .049 in. 2S 1/2H aluminum alloy sheet
1	48 in. x 12 in. .091 in. 2S 1/2H aluminum alloy sheet
¼	lb. aluminum rivets, 3/32 in. x 1/4 in.
1	4 ft. x 1/8 in. x 3/4 in. strap iron
1	9 ft. x 3/4 in. x .065 in. wall—aircraft tubing
1	12 ft. x 5/8 in. x .065 in. wall—aircraft tubing
5	1/4 in. x 3/16 in. clevis and pins
1	Rubber handle grip
30	1 in. #8–32 aircraft bolts and nuts
1	Aircraft pulley, 2 in. x 17/64 in.
1	4½ in. turnbuckle
4	3/8 in. tie rod terminals, threaded clevis type

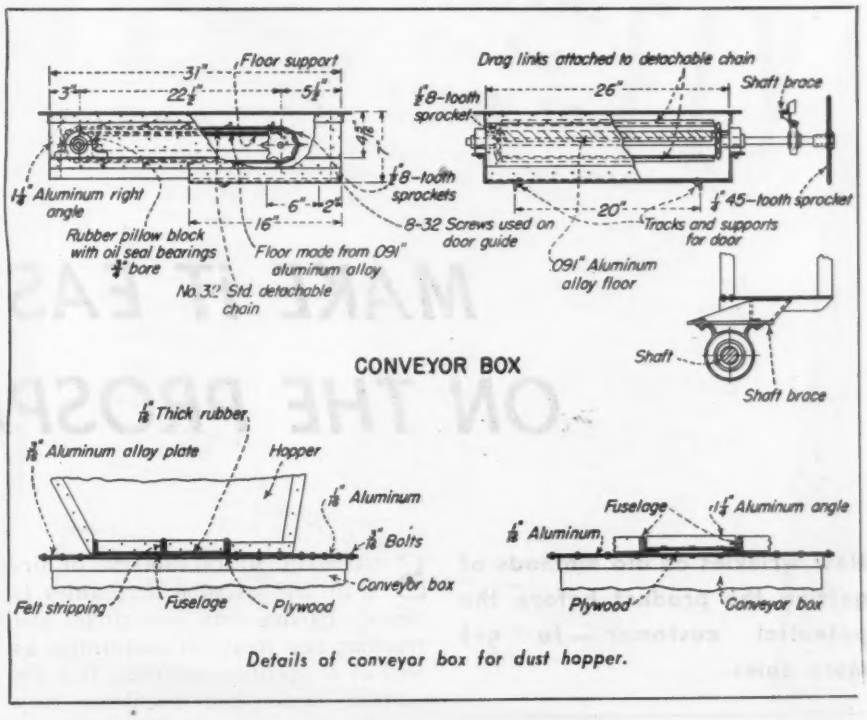
Side winds may blow the dust onto other crops, which thus may be damaged by the chemicals. In this case, the pilot may be compelled to pay for the spoiled crop. Permits must be obtained and reports filed after the work is finished. Most states require the operator to be licensed. Added difficulty lies in the fact that dusting cannot be done at any hour; it generally has to be completed early in the day, before the wind rises and while the dew is still on the plants, so that the dust will not become dislodged.

Listed by N. Y. State *Forestry News* are the following conditions which must be considered in many parts of New York State: On-shore winds commence blowing at sunrise, so that successful dusting must be done before that time. Fogs in valleys may prevent the pilot from recognizing the fields to be dusted. Furthermore, habits of each insect pest must be considered and allowed for; for instance, one low-flying open-cockpit plane crashed because of flying through a swarm of grasshoppers, which smeared the pilot's goggles, temporarily blinding him.

Disadvantages are mostly due to conditions of weather and terrain. It

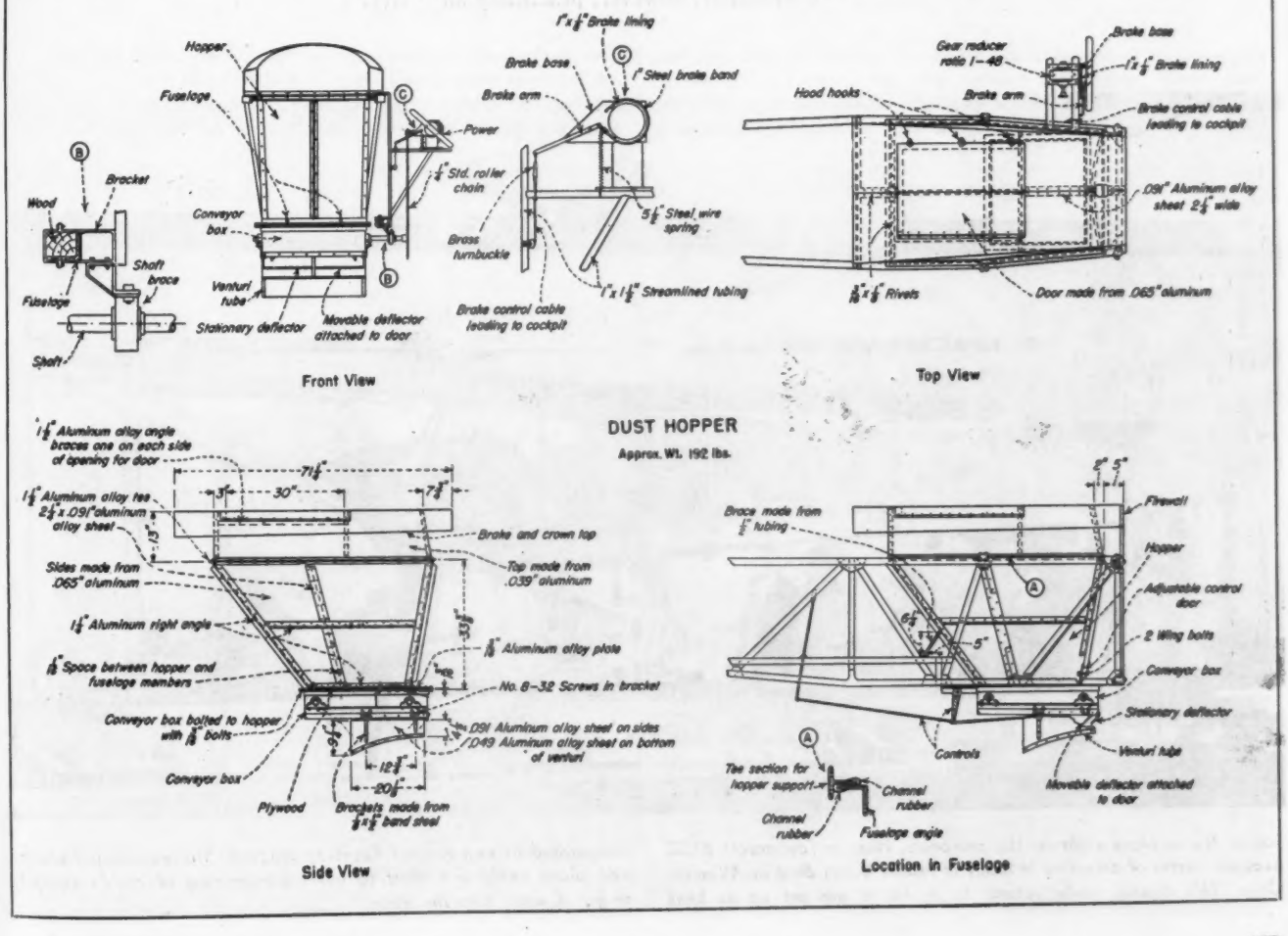
(*Turn to page* 246)

Doing fifty-fold the work formerly possible in the same time, and doing it faster and for less money, is the striking score of the crop-dusting airplane, the modern farmer's multi-purpose implement.



Details of conveyor box for dust hopper.

Dust hopper designed by U. S. Dept. of Agriculture for lightplanes.



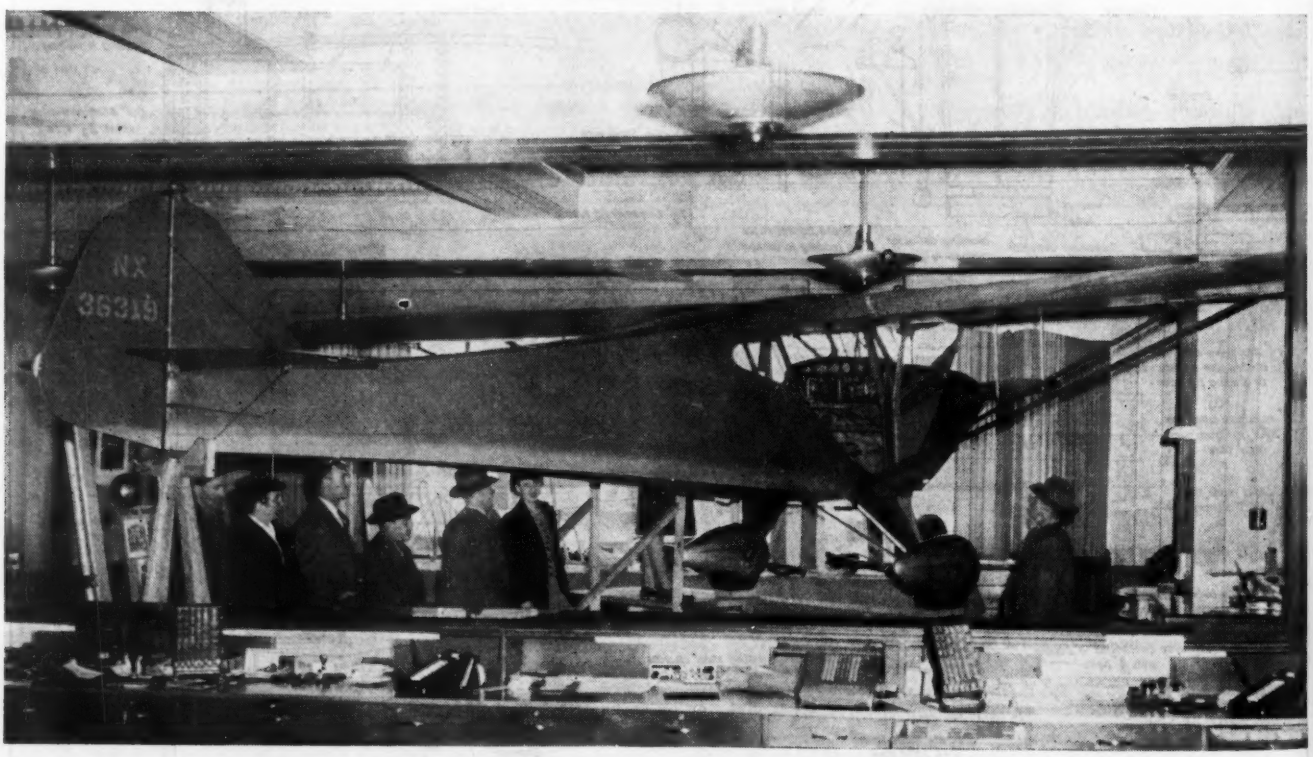
MARKETING

MAKE IT EASY ON THE PROSPECT

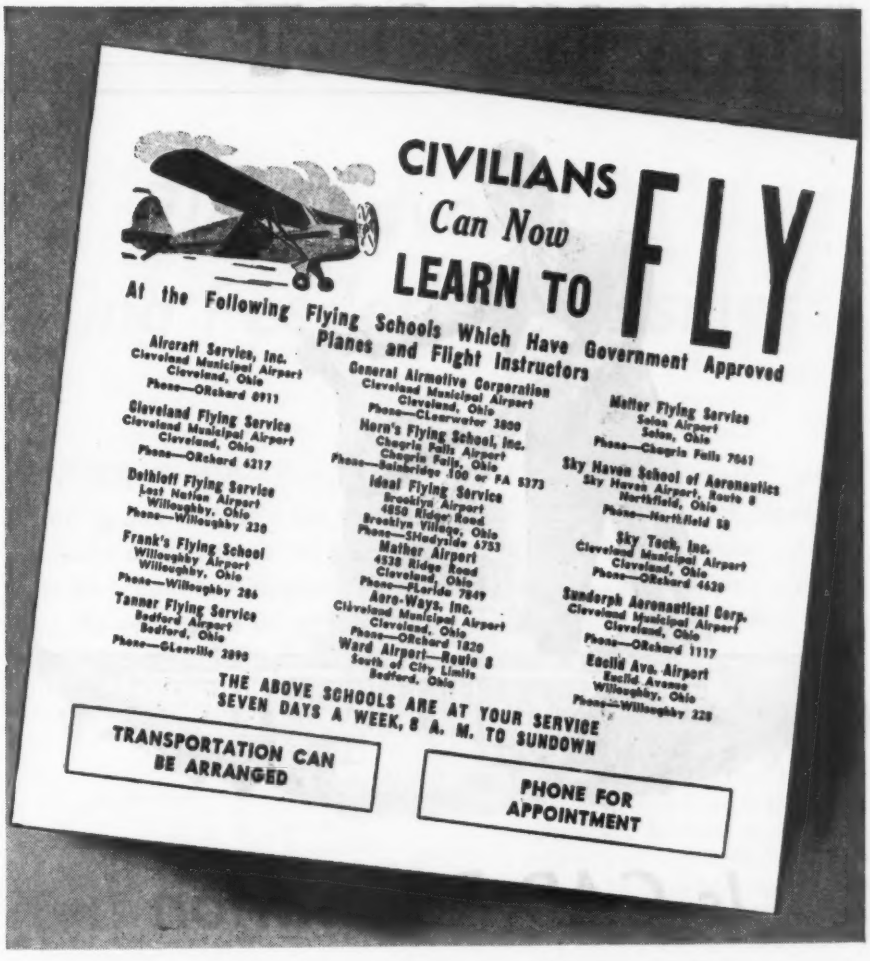
New wrinkles on old methods of getting the product before the potential customer — to get more sales.

SUCCESSFUL MERCHANDISING of aircraft and aviation accessories is already moving into new circles and reaching new means of cooperation as well as competition, indicting that the postwar dealer and distributor may well be adpoting methods unnecessary in the so-called "good old days."

Fortunately, however, practically all of these new angles of basically sound and long-proven distribution methods are within the reach of any enterprising dealer. And they can easily be adapted in toto or modified slightly to meet local conditions. The main ingredient of such ideas, as illustrated by the examples shown herewith, is initiative.

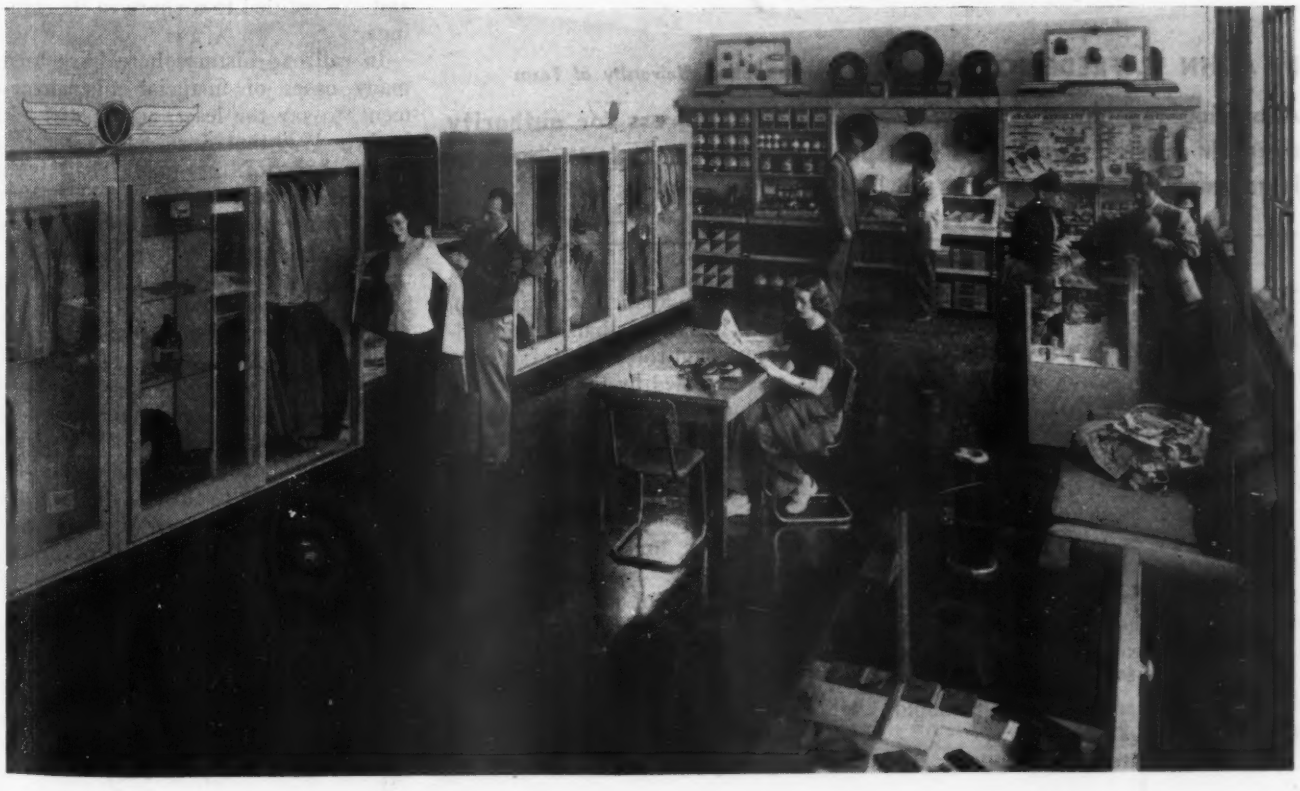


Taking the airplane right to the prospects. Here a Taylorcraft B12C becomes center of attention in lobby of Mount Union Bank in Alliance, Ohio. This display made natural tie-in, for it was set up as bank inaugurated its own aircraft financing program. Stairway rigged alongside plane enabled visitors to get close-up view of craft's cockpit, or get in and "take the wheel."



Cooperative advertising run by 16 operators in and near Cleveland. Business was developed on first day ad appeared, and results proved so satisfactory that same ad has reappeared several times without change. Law of diminishing returns does not apply, since each outlying operator has his own territory from which to draw; and those located on Cleveland Municipal Airport offer different types of services.

On Cleveland Municipal Airport — convenient to transient as well as local flyers — is this Firestone Aircraft Dealer store operated by Flight, Inc., which also conducts flight instruction school and has aircraft sales and service departments. Firestone makes available specially designed fixtures for displaying accessories. Moreover, its merchandising program includes national advertising, direct mail, and other promotion designed to assist aircraft distributors and dealers in broadening their sales—and profit-base.



TRANSPORT

Is CAB Regulation Of Airline Securities Necessary?

By **JOHN H. FREDERICK,** *Professor of Transportation, University of Texas*

Analyzing the Board's renewed request to Congress for authority over air carrier stocks, this transportation expert finds the answer is an emphatic "No."

IN ITS RECENTLY FILED annual report for the fiscal year ending June 30, 1944, the Civil Aeronautics Board again made a request to Congress that it be granted legislative authority to control airline security issues and capitalization. In making this request, the Board pointed out that such regulatory power was considered necessary to "prevent the development of economically unsound capital structures." The Board also mentioned that the Interstate Commerce Commission already had such authority over the carriers under its control and that this was a reason why it should also be granted such power.

From this statement it appears the Board feels the financial situation of the airlines is akin to that of the railroads before control of their security issues was assumed by the ICC, under the Transportation Act of 1920—or that the airlines may get into the same shape.. Truth of the matter is, however, that nothing could be more different than the financial structure of the railroads before and since 1920, as compared to the past and present financial structure of the airlines.

Federal regulation of railroad securities was necessary because these carriers had great quantities of various types of bonds outstanding. Fixed interest charges on these bonds were naturally in proportion to the volume of securities issued, and the revenues to meet these expenses were necessarily derived from shippers and passengers. The airlines, on the other hand, have no bonds outstanding at this time. Not one of them has any funds debt at all, since they are capitalized wholly on the basis of stock, either common or preferred, with only three having any of the latter.

Of course, those who make use of the railroads or the airlines have a direct interest in the volume and character of the securities issued by such carriers. The belief, once widespread, that, owing to the competitive and other economic conditions as well as government regulation, there is no direct relation between common carrier rates and capitalization—is no longer held to be true.

In rate cases where rate schedules, rather than individual rates, have been involved, the railroads have nearly always attempted to show that their net income after paying cost of operating and fixed charges has not been sufficient to yield a fair return to stockholders. The need for increased revenue through increased rates has, therefore, been urged. Under such circumstances it is of vital interest to shippers and other users of a railroad whether the outstanding securities of such a carrier represent actual value and are entitled to a share in its earnings.

In railroad history there have been many cases of financial mismanagement, to say the least, and it was felt back in 1920 that since, as investors, a large share of the public had been affected by the amount and character of railroad securities issued, it therefore needed the protection of Federal regulation to assure that funds were being wisely used and investments protected from unwise financial operations.

Federal regulation of railroad securities was also thought necessary to protect the carriers themselves from improvident financing which might impair their ability to furnish their specified service, performance of which was the reason for their existence, and upon which they depended for their livelihood. Without such regulation it was possible for a limited number of railroad companies, by speculative and irresponsible financing, to bring all railroad securities under suspicion. If this happened it would be difficult for

(*Turn to page* 262)

"Elastic Traffic" Plan Advocated For Building Feederline Business

By JOHN W. MOORE, *Air Transport Traffic Manager, Port of New York Authority*

Pointing out that it's the flexible service which will best meet the variable demands of feeder transport, this traffic analyst advises special-scope certificates for feeder airlines—certificates permitting the operators leeway in their schedules and stops so that they may take greatest advantage of seasonal traffic fluctuations.

It is the popular supposition that the feeder airline and the trunk airline are closely related in a kind of "little brother and big brother" kinship. True, they do have a great deal in common—but their operational problems are quite different.

Trunklines, which primarily serve the principal traffic centers, operate under an authorization which definitely fixes both the termini and all intermediate points. If mail is carried, schedules and time of departure are prescribed by the Post Office Department. The only time a trunkline stops at a small city—which can provide only a limited amount of traffic—is when such a call is required for operational or fueling purposes.

The one hope of most small cities and towns for air transportation lies in the intensive development of secondary service or feederlines. Such business as that offered by small non-industrial towns, out-of-the-way beach and mountain resorts, or by seasonal passenger and seasonal express traffic, or general schedules involving short runs and frequent stops at small airports, are not attractive to the trunk airlines. But, taken as a whole, there is sufficient business to support an efficient feeder service.

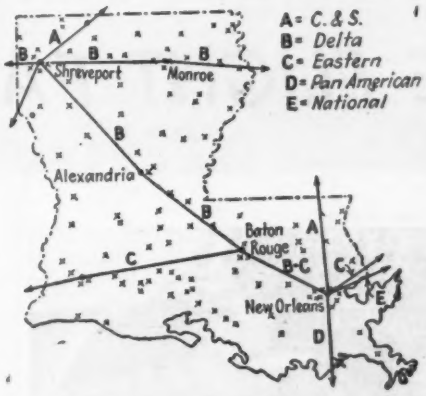
As now constituted, regulations call for certificates specifying certain definite operations—so many flights to so many places, with almost no latitude for variations. This system was formulated for trunk airlines, and with them it works remarkably well, because their volume of business permits them to maintain operations over the same schedules and make money doing it.

Consider, however, the plight of the non-trunkline operator under this type of certificate.

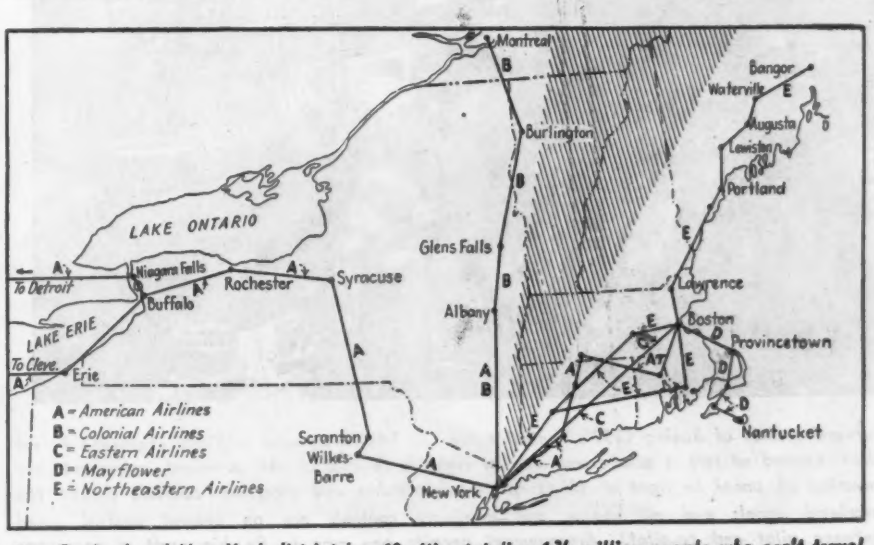
It is extremely unlikely that feeder service will compete with the major airlines for air traffic between the larger cities. The necessity of stopping at numerous small and medium sized cities en route means that the time schedule will be considerably slower than that of the trunk airline. The non-trunkline operator finds that most of his passenger business is seasonal. With inclusion of air express he often finds enough business to keep his line out of the red, but his operation cannot be charted for the future in the manner now required to obtain a regular airline certificate.

Visualize the seasonal variation which might be found in the traffic available to a feederline operating from the densely populated area around New York City to Atlantic City and Cape May, N. J., where the summer daily traffic is often 50 times as great as in the winter months. Consider also the winter ski excursions to the snow covered mountains of New England.

(*Turn to page* 251)



State of Louisiana, with 2,000,000 population, has 27 airports, with 83 projected—but only five airline stops. Need is great for feederlines to connect outlying communities with airline centers.



New England and New York district has 60 cities totaling 1¾ million people who can't travel by air without first going to another town. This is excellent feederline territory.

COORDINATED CONTROLS RELIEVE FLIGHT FATIGUE

Forward section of Boeing C-97's control cabin. In left foreground is flight engineer's swivel chair, beyond at left is pilot's seat and at right is co-pilot's. All principal instruments are mounted on panel in front of pilots; principal switches and electrical controls are on the overhead panel; and all engine and accessory controls are on central control stand between pilot and co-pilot. Arrangement permits one man to fly big craft if necessary. (All Boeing photos)

NEW STANDARDS of airplane control cabin efficiency—simplicity and centralization of controls, convenience of operation, and visibility—are to be found in the new Boeing C-97 AAF transport, the military counterpart of the company's postwar Stratocruiser airliner.

Five persons comprise the C-97's flight crew—pilot, co-pilot, flight engineer, avigator, and radio operator. Pilot and co-pilot are seated in the nose, away from the cabin side windows. Between and just behind them is the flight engineer. The avigator's position is directly behind the pilot, while the radio operator is stationed behind the co-pilot.

On a normal long-range mission, the full five-man crew is carried, but on short-range flights it is feasible to fly the C-97 with only a pilot and co-pilot. Furthermore, the plane's controls are so located that in an emergency it is possible for one man, seated in the co-pilot's seat, to operate the big craft.

Boeing's arrangement segregates the various classes of equipment required by pilot, co-pilot, and flight engineer. Approximately 70 instruments and 65 switches comprise the operating

Boeing C-97's centralized control cabin features special instrument layout and single control stand so located as to enable one crew member to operate big craft, also permits better crew teamwork.

controls. All principal instruments are located on a panel in front of the pilots. Principal switches and electrical controls are placed on an overhead switch panel. All engine and accessory controls are located on a central control stand which is immediately in front of the flight engineer and between the pilots, conveniently accessible to all three men. It is this central control stand, probably the oustanding feature of the C-97's control cabin, that makes possible the aforesaid one-man operation of the plane from the co-pilot's seat. Except for certain fire control equipment, all operating controls are also available to the pilot.

All instruments may be read and, except as noted above, all switches and controls may be reached by the pilots and flight engineer. However, instruments, switches, and controls are so positioned as to make them easiest to read or be reached by the crew member whose normal function includes the use of that particular device. For example, the vacuum selector valve and fuel selector controls are handier to the flight engineer than to the pilots, since these operations are normally a flight engineer's function.

This location of a single control stand in the center of the cabin prevented the usual arrangement of fitting the two pilot seats flush with the side windows. However, adequate rearward vision is provided by judicious placement of side windows. The No. 3 engine can be seen by looking through the radio operator's window, and the No. 2 engine is visible through the avigator's window. The two outboard engines are viewed through the windows alongside each pilot. Vision directly aft is provided through the astrodome, which is on the top centerline of the fuselage slightly behind the flight engineer's station.

Since the pilots are seated directly in the plane's nose, with its large number of windows (most of which are flat-surfaced so as to prevent distortion), the general flight vision up, down, and forward is excellent.

With pilot, co-pilot, and flight engineer in such close proximity, maximum coordination between them is accomplished with a minimum of effort. Noise levels in the control cabin are little higher than those of the average busy office, and conversations can be carried on in normal tones. During long-range flights, two of the three men can leave their flight stations for relaxation, since it is not necessary for more than one of the trio to be at his post during routine cruising conditions.

With the avigator located directly behind the pilot, and the radio operator behind the co-pilot, communication between the crew is possible without using interphone equipment.

The avigator has a table which will handle large charts laid flat, and he also is provided with a commodious storage compartment. He uses the astrodome by standing on a platform adjustable to the proper height. The radio operator also has a table and cabinet, with all his equipment compactly and conveniently located. This equipment is attached to the rear face of the central control stand and is removable when not in use.

That the C-97's control cabin arrangement is efficient was proved during the big craft's spectacular flight last January when it flew from Seattle to Washington, D. C., in the record time of 6 hr., 3 min., 50 sec.

To the occupants of the control cabin, the C-97's ease of operation, convenience, and comfort was the most noteworthy feature. They reported that the trip was made without fatigue or strain and that they felt fit and ready to start a return flight to Seattle at once.

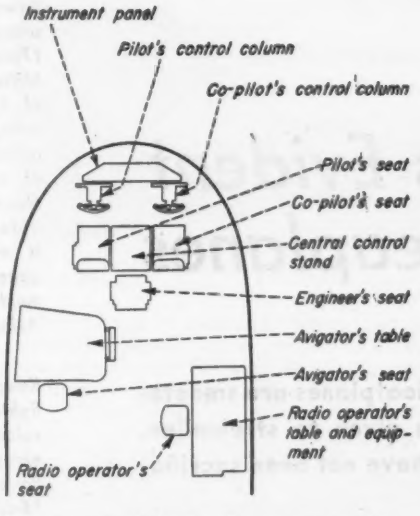
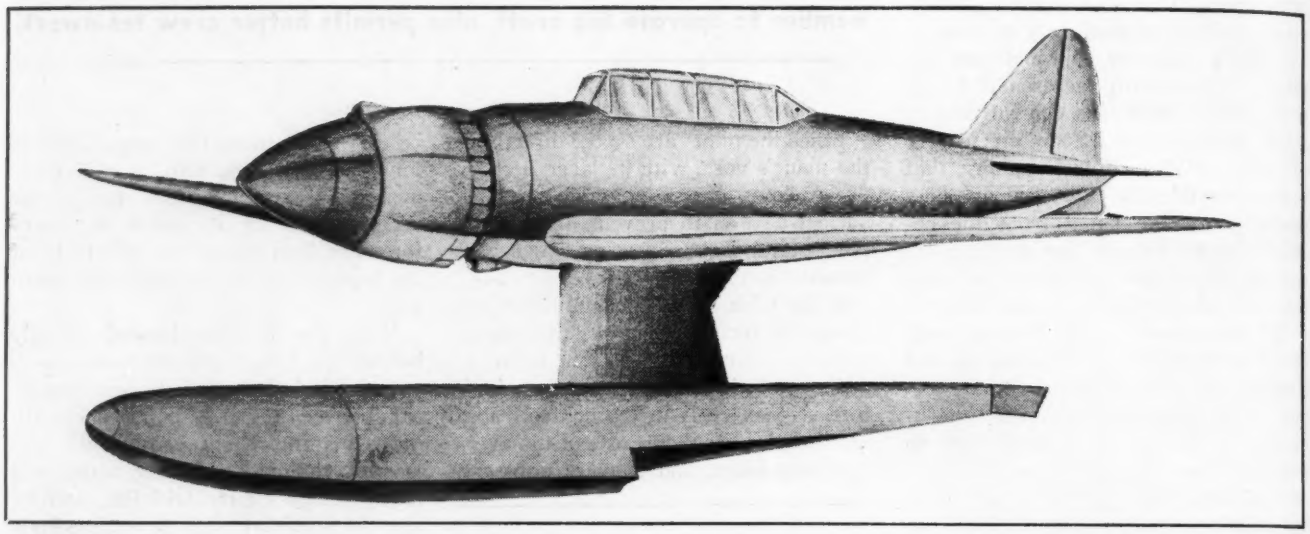


Diagram of control cabin arrangement on C-97 shows location of craft's five-man crew and placement of central control stand adjacent to pilot, co-pilot, and flight engineer.

Radio operator of C-97 is seated behind co-pilot at rear of the control chain.

Avigator is located on port side aft of pilot. He faces forward.

MILITARY

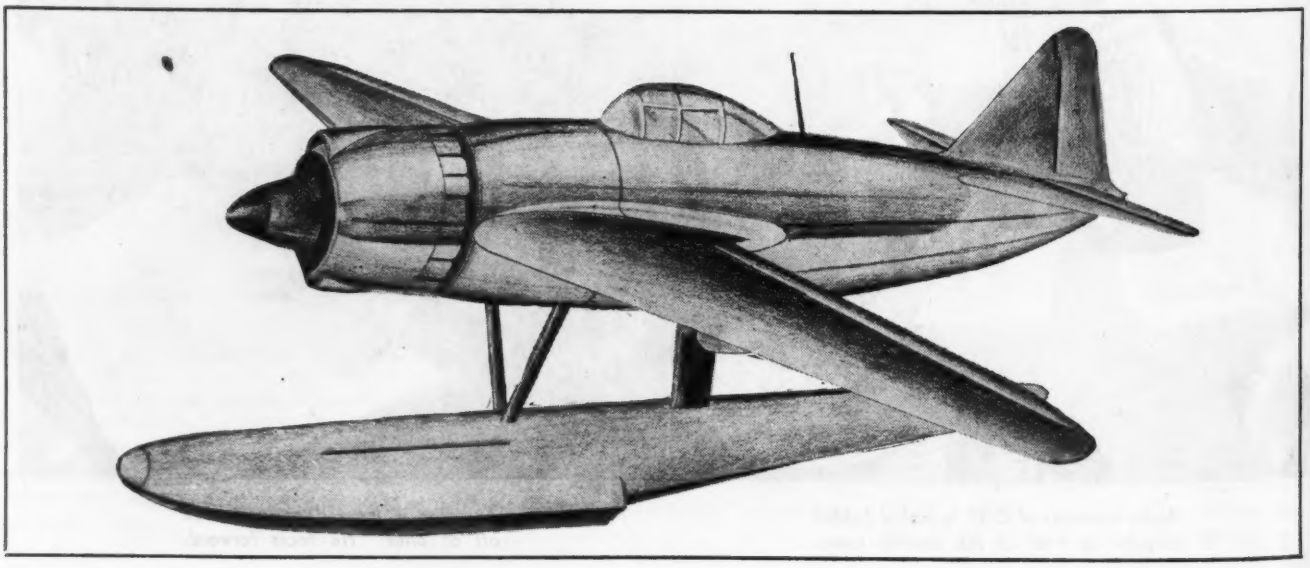


Kawanishi Norm 11 is a two-seat single-float seaplane used for reconnaissance. Jap name is Shiun (Painted Cloud). Powered by either a 1,400-hp. Mitsubishi Kasei 14 radial engine or a Kasei 24 of 1,720 hp., craft has several unusual and interesting features, including contra-rotating propeller, a large streamlined spinner covering entire front of engine cowl, and fully retractable wing floats. Norm has ejector-type exhaust stacks and large wide-chord flaps. Construction is all-metal. Span is approximately 46 ft., and over-all length is gaged at 37 ft. 7 in. No performance or armament details are yet available. (Sketches by Aviation staff artist.

Improvements Evident In New Jap Seaplanes

Recently introduced high-powered floatplanes are smooth-looking craft, with much attention given to streamline. Designs seem to indicate that Nips have not been sacrificing research for quantity.

Kawanishi Rex 11 is a single-place single-float fighter, from which Nips' George landplane was developed. Design is very much similar to that craft, except that former's wings are in a lower position. Powered by a 2,000-plus-hp. Nakajima Homare 18-cyl. radial engine, Rex has a top speed of about 400 mph. Wing floats are retractable, but do not fold flush with wing's undersurface as on Norm. Span is about 40 ft., and craft has an over-all length of approximately 35 ft. Jap name for Rex is Kyofu (Mighty Wind).



FLYING EQUIPMENT

Spartan Building 4-5 Placer For Business Flying

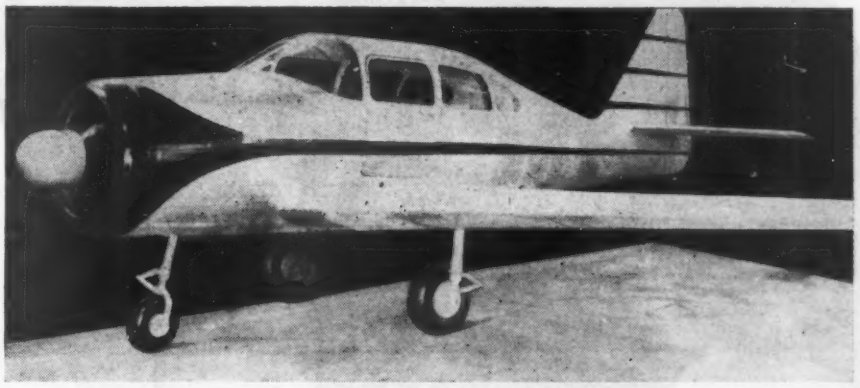
Craft is to be an improvement on prewar Executive 7W, with new features to include magnesium components and retractable tricycle landing gear. In $14,000-$20,000 class, design will include mail and cargo pickup versions.

SPARTAN AIRCRAFT CORP., Tulsa, Okla., is readying a new, post-war four-five place, single-engine all-metal craft designated the Executive 12. Now under construction, the plane is expected to be flying by early Fall.

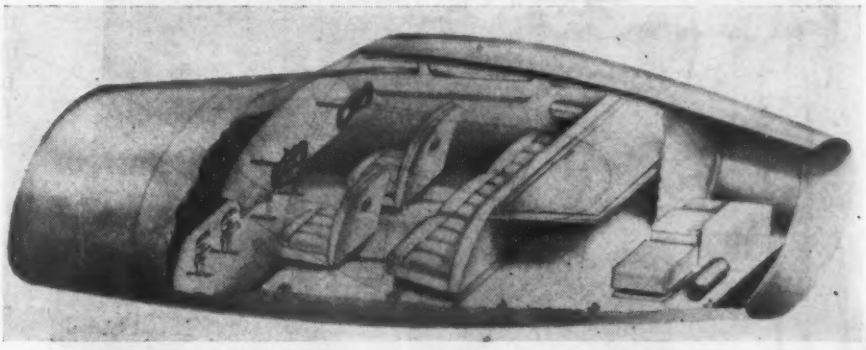
Similar in several respects to the company's prewar Executive 7W, the new type will have a retractable tricycle landing gear, and construction is intended to utilize many components of magnesium in fin, rudder, stabilizer, elevators, and outer wing panels. Studies made by the company indicate a weight saving of 5.7-12.2 percent for these parts through use of this material instead of aluminum alloy.

To be powered with a 450-hp. P&W Wasp, Jr., the new craft will have an estimated cruising speed of 203 mph., a 1,265-mi. range with 150 gal., or 1,097 mi. carrying an alternate capacity of 130 gal. For landings and takeoffs, a separate 15-gal. fuel tank for 87-octane fuel is to be used.

When fitted with the larger fuel tank, four passengers would be carried, with a 43.5-lb. baggage allowance per person. Five passengers would be carried with the 132-gal. tank installed, with a luggage weight allowance of 30 lb. apiece. It is stated that weight empty of the passenger version fully equipped would be 2,846 lb., and gross weight is to be 4,694 lb. Modified for cargo operations, the Executive 12 is to weigh 2,785 lb. empty and is to have a minimum payload of 896.33 lb. Designed for mail and cargo pickup, the craft will carry 602 lb. of mail and express, plus equipment, which would be of the All American Aviation type, and it is stated that the load could be increased as fuel is consumed.



Here is mockup of Spartan Executive 12 showing retractable tricycle landing gear, an unusual feature for a radial-engine design. To be powered by a 450-hp. P&W Wasp, Jr., craft will have an estimated 203 mph. cruising speed. Outer wing panels, fin, rudder, and stabilizer are to have magnesium components.



Interior of Executive's mockup depicts seating and luggage layouts. Seats will have foam rubber cushions. Luggage is to be accessible from cabin interior as well as from outside. Throttle and propeller control unit will be mounted on instrument panel. Landing gear and flaps are to be electrically operated.

Specifications and Data

Cruising speed	203 mph.
Range (130 gal. fuel)	1,097 mi.
Range (150 gal. fuel)	1,265 mi.
Weight empty (passenger)	2,846 lb.
Weight empty (cargo)	2,785 lb.
Payload (cargo)	896.33 lb.
Gross weight (passenger)	4,694 lb.
Seating	Four-Five
Power plant	450-hp. P&W Wasp, Jr.
Propeller	Hamilton Standard two-blade constant speed
Price	$14,000-$20,000

Luxurious furnishings are planned for the cabin interior, including foam-rubber cushioned seats. Head rests, window drapes, magazine pockets, map cases, and ash trays are optional equipment. The luggage compartment is to have a large outside door, with lock, as well as an access door in the cabin, and it will be lined with a scuff-proof material to protect baggage. Pressurized forced air ventilation will be included, while heat will be available from a device utilizing air passing through the engine oil cooler in order to eliminate any possibility of exhaust gases entering the cockpit. Landing gear and split wing flaps are to be electrically operated.

It is stated that the new craft will

(*Turn to page* 256)

Capacity

Modern, large capacity equipment, skillfully operated and carefully supervised, assures quantity with quality.

...to deliver molded oil-paper capacitors . . . in quantities more than ample for your needs . . . and in exact agreement with American War Standard C75/221 . . . is afforded by batteries of these dual-77-cavity monsters. Fed with oil-impregnated, aluminum-foil-wound, non-inductive sections and pre-forms of mica-filled phenolic, these huge presses are continually pouring forth capacitors of uniformly high quality with the consistency of characteristics for which Tobe products are famous.

So, however great may be your consumption of molded oil-paper capacitors, Tobe can deliver them in volume. Capacitance ranging from 1000 to 50,000 mmfd: working voltages from 120 to 800 volts d-c: shunt resistance as high as 40,000 megohms at 25°C: power factor as low as 0.004 at 1000 cycles: and moisture seal that meets all thermal cycle, immersion, and humidity requirements.

TOBE DEUTSCHMANN CORP.
TOBE
CANTON · MASSACHUSETTS

FIELD OFFICES IN NEW YORK CITY • CHICAGO • DETROIT • GLENDALE, CALIFORNIA

Tudor and New Aerovan Groomed for British Airlines

Two widely differing craft make their appearance — A crack 24-seater for trans-Atlantic routes and a light passenger-cargo "caravan" type for low-cost operations.

ANOTHER BOOST to British postwar commercial aviation prospects was seen in the recent appearance of two new craft, the Avro Tudor I, a 34-ton pressurized-cabin airliner, and the unorthodox-looking Miles M-57 Aerovan, a small wooden craft especially designed for aero bus operators, general feeder work, or cargo flying at economical rates.

Avro Tudor I. First British luxury airliner to make its appearance is the Avro Tudor I, which was flown for 38 min. on June 14. Production is scheduled to begin this month, and BOAC has placed orders for 20 of the craft, which are intended for use on trans-Atlantic runs.

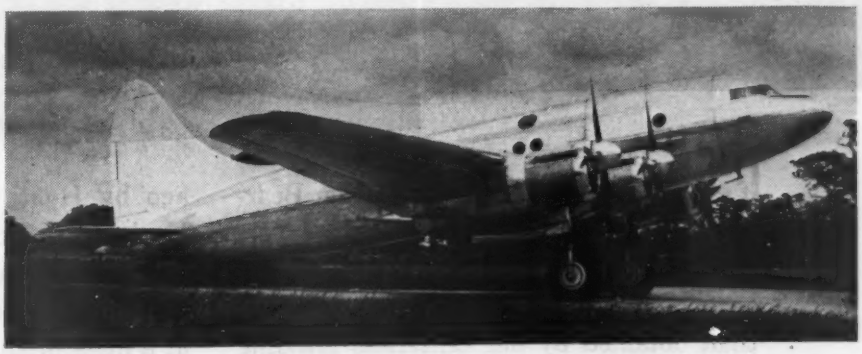
Of all-metal construction, the Tudor is powered by four Rolls-Royce engines in new-type circular cowlings, and fitted are four-blade DH hydromatic feathering and reversible pitch propellers. Stated top speed of the Tudor is 346 mph. at 20,000 ft., and cruising speed at this height is given as 295 mph. for an estimated 3,700-mi. range. Maximum range, at the same altitude, would be 4,660 mi., flying at 230 mph.

Span is 120 ft., length 80 ft., and height, 18 ft. The circular fuselage is 10 ft. in dia., and a pressurized-cabin atmospheric pressure equal to that at 8,000 ft. is planned. In addition, both cabin and flight deck are air-conditioned. Baggage and freight capacity is stated to be 3,730 lb., and disposable load is said to be 38½% of the craft's total weight. Fuel capacity is given as 3,460 gal.

Accommodations are to be provided for twelve passengers, employing lounge chairs which are convertible to berths. This would be the standard arrangement for distance flights. The "day" version will seat up to 24.

It is stated that in several months a larger Avro Tudor II will be ready to make its first flights, and production on that design is expected to begin early next year.

Developed especially for low-cost operations, Miles' new Aerovan can be powered by two Gipsy or Cirrus engines of 140-150-hp. each. External flaps are of Miles design, and a large single side-opening door is fitted in rear of fuselage.



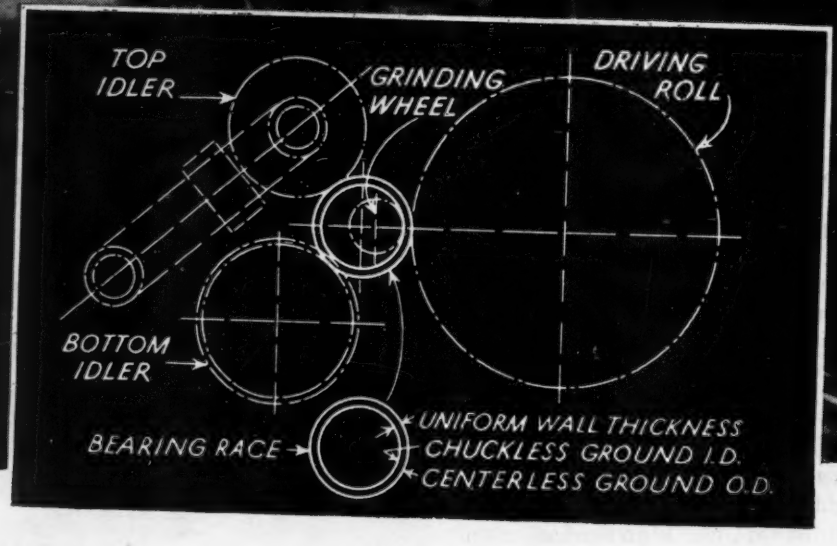
New Avro Tudor I airliner, 20 of which are scheduled for use by BOAC in trans-Atlantic operations. Powered by four Rolls-Royce Merlin engines in new-type cowlings, craft is designed to carry 24 passengers at a top speed of 346 mph. Design is akin to Douglas DC-3 and Curtiss Commando.

Miles M-57 Aerovan. Called one of the most versatile airplanes yet produced, this new Miles craft is a high wing monoplane, mostly of wooden construction, and with power supplied by two Gipsy Major or Cirrus Major engines in the 140 hp.-150 hp.-each class. The manufacturer gives some of the proposed uses of the new craft—as a flying caravan for the air tourist, as a light passenger or cargo plane, as a flying operating room, or for aerial pickup.

Of tadpole-like shape, the fuselage is all wood. There is a fixed tricycle landing gear with medium pressure tires, and the nose wheel is steerable. The high-mounted tail boom is of metal, and to this is attached cantilever tail surfaces fitted with three fins and horn-balanced rudders. The control cabin, which also will seat an extra passenger, has a very large molded Perspex windshield, affording a wide

(*Turn to page* 255)

We built the skill of the craftsman into the machine!



If every raceway for a Hyatt Roller Bearing were painstakingly fashioned by expert tool makers they could be no more concentric or of more uniform wall thickness than obtained by our centerless grinding machine production.

First we externally grind by our improved arborless grinding method. Then the perfect outside periphery thus obtained is used as a guide in grinding the inner diameter of outer races, the track upon which the rollers operate.

This new principle invented several years ago by Hyatt Methods and Equipment Engineers we call "Chuckless Grinding." Thus into the machine we built the skill of the craftsman and precision manufacture at a mass production pace was born.

This is just another example of the many exclusive manufacturing processes which enable us to build accuracy, longer life and more dependable performance into Hyatt Roller Bearings for every application.

* * *

Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

WALL STREET EYES THE LIGHTPLANE MAKERS

By **RAYMOND L. HOADLEY,** *Financial Editor, "Aviation"*

Some investment advisers say, "Get on the bandwagon;" others advise, "Wait and see." Here are the factors behind these divergent lines of reasoning.

NOW THAT CIVILIAN AVIATION is gradually coming back into the spotlight and private planes are again in production, Wall Street is beginning to show interest in the personal plane companies for the first time.

So far this interest has not resulted in any large scale buying, but the brokers are definitely busy, intent on familiarizing themselves with this important group in the aircraft industry and in weighing carefully the pros and cons of their postwar prospects.

Already two schools of thought have appeared in the financial district regarding the civilian plane concerns. Some stock market analysts are on record in favor of speculative commitments in this group, while others are just as firmly "agin' 'em."

Argument of those who like the personal plane manufacturers runs something like this: The war has created new horizons for the personal plane maker; 400,000 civilian airplanes are invisioned in the skies within 10 yr. after the war, compared with less than 25,000 at the time of Pearl Harbor. Some of these "likers" visualize postwar personal aircraft sales of approximately $100,000,000 within 5 yr., compared with prewar sales of only a few million dollars a year.

They point to 6,000,000 potential flyers. There are, they say, 350,000 Army and Navy pilots, and 150,000 civilian pilots and students, in addition to 2,500,000 men trained by the armed forces in other aviation skills and almost the same number that have been employed in aircraft plants. Then adding 250,000 high school aeronautics students, they arrive at the 6,000,000 prospective airmen figure.

Some are bullish on the personal plane company outlook purely from the merger angle. These concerns, they maintain, have speculative appeal simply on the chance that some of the big fellows will want to get quickly established in the personal plane field via the merger route—buying up small companies that have a successful personal plane production record behind them. There have been some preliminary negotiations along this line in the past, but nothing ever came of them.

As an alternative, they point to the attractive possibilities of two or more personal plane companies banding together in a combination, something akin to the abortive Beech-Cessna merger. In this case, it is noted, the new outfit was to have a broad line of 2- to 15-passenger jobs to offer the public under one distributor's contract. Officials of Beech and Cessna anticipated substantial operating and manufacturing economies, while another advantage expected by merging was increased working capital of the new company.

However, in the week following the initially strong merger move, the stocks of both Beech and Cessna moved up only about one point. And this in a week when aircraft stocks generally were strong on the stock market.

One of the strongest arguments made in favor of the personal plane stocks is similar to that advanced for the so-called independent automobile stocks. It is pointed out that the wartime activities of a number of the personal plane makers have enabled them to expand their plants and personnel and, what is equally important, strengthen their working capital position.

The sales totals recorded by twelve personal plane companies last year came to the amazing sum of $354,033,000, approximately $125,000,000 more than the sales of the entire aircraft industry in 1939. Aggregate net profits for the group were $9,041,000, off slightly from the $9,595,000 reported in 1943. And this was due largely to cutbacks in the trainer and other lightplane military programs. Current assets came to $12,095,000 at the 1944 yearend against current liabilities of $9,563,000. More than $1,500,000 was added to these companies' reserves, bringing them to a total of $4,750,000. Their bank debt stood at $22,500,000, and the tax refunds due them after the war (or possibly before) amounted to $4,367,000.

Furthermore, some of these com-

(*Turn to page* 253)

SIDE SLIPS

TRYING TO READ himself to sleep the other night with a western magazine, one of the country's top jet engineers came across an illustration of a six-horse stage coach careening round a bend. Suddenly intrigued, he got out his slip-stick and, figuring probable costs of horses, oats, hay, stagecoach, depreciation, drivers' salaries, and what not, arrived at a ton-mile cost. Then he figured the ton-mile costs of one of the nation's newest jet planes, getting a figure very close to that of the stagecoach.

Next day, at a very important meeting of the country's top jet engineers, he proudly reported his findings. But they were quickly and thoroughly challenged; another engineer said the figures were all wrong because he had neglected to consider the jet effect of the horses.

• The young pilot was looking over a jet job very carefully, moving back from the wingtip till he almost fell over the engines, which were awaiting installation. Finally he moved over to the thoroughly harassed and hurried crew chief and asked, "Say, where does the exhaust come out of this thing?"

The chief was so completely baffled he could only ask, "What did you say —sir?"

"Where does the exhaust, or whatever it is that drives this thing, come out?"

"From the back end of the engines —sir."

"Oh." A pause, then, "Yeah, but where do they sit?"

Pointing to the engines the chief replied, "Right over there, sir." As the baffled pilot backed out from under the wing he hit his head on one of the engine attaching fittings, whereupon the chief said quietly, "The engines will go right there, sir, and the exhaust will come out right here."

"Maguire's going to build those postwar planes right now no matter what he has to do to get materials."

• Commenting on a new aeronautical publication, a book reviewer speaks of the "horizon stabilizer"—a gadget we'd certainly love to have. Now if someone will only develop a landing smoother outer . . .

• "Wonderful", it seems, is the only word to describe the politician and his ways of working. New York City's now-abuilding Idlewild airport is proof if there ever was any. The other day we watched concrete being poured for part of one of the 10,000-ft. runways, then we saw a beautiful scale model showing where all the rest of the runways and other appurtenances are to go. We also saw an anemometer busily recording the wind directions and velocities. A little inquiry brought out the fact that *now*—after the whole project has been planned and the first of two hundred million taxpayers' bucks have started on their merry way —*now* they're starting to find out what the weather's like.

• The Nazis discovered what to do with salesmen who no longer could hit the road to sell—and they didn't send them to Berlin to become liaison men, either. But their fate was nearly as bad, as one of our scientific mission men recently found out.

This American and his confreres spent a very irritating morning questioning a Kraut who'd been pointed out as a big shot in one of the German aircraft engine plants. But all they got from him was double talk—very suave, very courteous, but still double talk. Finally they gave up and escorted said Kraut back to his office where, painted in large bold letters on the door, was what the American swears was the title "Diplomatic Engineer."

• With no little fascination, we read in a recent issue of the *Harvard Business Review* a piece on "Postwar Status of the Aircraft Industry" by William Burden. In it he refers several times to the "gasoline turbines"—and we're still wondering if this is a new line of development or if Harvard proofreaders are just congenitally opposed to using the word gas, thinking it an abbreviation.

U. S. Navy's Latest Jolt for Japs—The Grumman Tigercat

Out of a dozen years of experience in building carrier based fighters, and the applied lessons of current combat, has come the Navy's newest fighting airplane—the Grumman Tigercat. In the skilled hands of Marine pilots the new F-7-F will write new pages in the log of carrier warfare.

Grumman

AIRCRAFT ENGINEERING CORPORATION · Bethpage, L. I., N. Y.

Over 700 miles per hour!

CURTISS WIND TUNNEL SPEEDS DESIGN PROGRESS

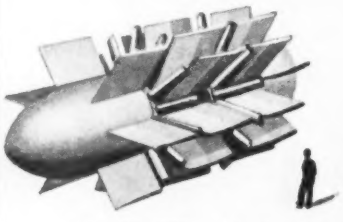
1 Into the 8½ x 12 foot test chamber goes a 10 foot span model. Sealed off from the balance of the tunnel, models may be changed or worked on in the chamber without affecting the test pressure of the tunnel itself.

THE aerodynamicist deals in the shape of things to fly. His workshop is a wind tunnel. His aim, to determine the behavior of full-size aircraft under all conditions before they are ever built or flown.

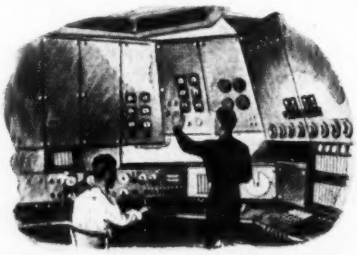
For him Curtiss-Wright constructed within its Buffalo Research Laboratory the largest, costliest variable density wind tunnel ever owned by a single aircraft corporation.

By compression or evacuation the air in the tunnel may be varied from 4 to 60 pounds per square inch to enable tests formerly requiring three or four tunnels.

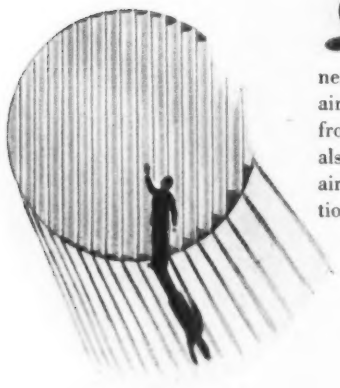
Here, with no risk in human life and with tremendous savings in the time and money involved in building and test flying full-size aeroplanes, Curtiss-Wright speeds the development of aviation that all the world may more quickly and fully share its benefits and bounties.



2 Twin 16 blade, 22 foot diameter fans driven by a 14,000 horsepower motor capable of whipping 210,000 cubic feet of air through the tunnel test chamber at speeds approaching the velocity of sound.



All wind tunnel operations are controlled from this Console. The reactions of the model under test such as Lift, Drag, Pitch, Roll, Yaw, Crosswind and Load Pressure are recorded on dials automatically fed into special IBM tabulating machines. Within 20 minutes these mechanical marvels compute and deliver a mathematical picture of test results that would otherwise consume weeks of laborious human calculations.



3 Giant vanes at the corners of the wind tunnel direct the air around the turns, prevent it from "piling up" at the sides. Here, also, coolers take the heat from the air built up by the tremendous friction of many times tornado speed.

CURTISS AIRPLANES
DIVISION OF
CURTISS WRIGHT
FIRST IN FLIGHT

SHEET NUMBER D-31
CLASSIFICATION . . . . . Materials
SUB CLASSIFICATION . . . . . Contact Alloys

Properties of Contact Alloys

FOLLOWING PROPERTIES affect either the life or performance of electrical contacts: (1) *High melting point,* desirable because it reduces susceptibility to disintegration and roughening under arcing conditions; (2) *high specific heat,* giving higher thermal capacity and reducing temperature rise; (3) *high thermal conductivity,* which permits rapid transmission of heat from contacts to backing material, reducing tendency to oxidize; (4) *low specific resistance,* giving high electrical conductivity; (5) *low temperature coefficient of resistance* in order that circuit resistance will not change with temperature increase; (6) *low expansion coefficient,* which results in better alignment and maintenance characteristics; (7) *low contact*

Alloy	Percent	Specific Gravity	Melting Point	Thermal Conductivity	Coeff. Linear Expan.	Ultimate Tensile Strength	Brinell Hardness Number	Specific Resistance	Coeff. Elec. Resistivity
			Deg. C.	Watts(1) cm.deg.C. at 20 deg. C.	Per deg. C.	Lb./in.²	10 mm. ball 500 kg. load	Microhm-cm. at 20 deg. C.	Per deg. C. at 20 deg. C.
Ag-Pd	0	10.5	960	4.19		20,000	45	1.62	.0038
%	10	10.64	1,080	1.44				6.0	.0010
Pd	20	10.79	1,200	0.85		30,000	65	10.0	.0005
	30	10.95	1,250	0.58				15.0	.0004
	40		1,300	0.46		42,000	85	22.0	.0004
	50		1,350	0.32				32.0	.0003
	60	11.44	1,400	0.27		45,000	100	41.0	.0003
	70		1,440	0.32				41.0	.0004
	80		1,480	0.37		45,000	90	32.0	.0008
	90		1,510	0.48				21.0	.0012
	100	12.0	1,555	0.67		30,000	49	10.0	.0038
Ag-Cu	0	10.5	960	4.05		20,000	36	1.62	.0038
Ster-	7.5	10.29	894			39,000	48	1.914	.00374
ling	10	10.3	890	3.45			58	1.845	.00365
Coin	20	10.15	820	3.38	.000018		58	1.845	.00370
%	30	9.95	780	3.25			58	1.844	.00376
Cu	40	9.8	810	3.11			58	1.913	.00380
	50	9.65	860	3.12				1.911	.00377
	60		900	2.75				1.909	.00374
	70		930	2.63				1.900	.00382
	80		970	2.67				1.895	.00387
	90		1,030	3.03				1.832	.00389
	100	8.89	1,083	3.82		35,000		1.706	.0039
Ag-Au	0	10.5	960	4.19		20,000	36	1.62	.0038
%	10	11.4		2.30					.0020
Au	20	11.5	980	1.50					.0012
	30	12.0		0.99	.000014			7.65	.00090
	40	13.0	1,020	0.90					.00080
	50	13.5		0.77	.000016			10.09	.00072
	60	14.7	1,040	0.76	.000016				.00072
	70	16.7		0.76	.000016				.00077
	75					27,000	32		
	80	17.0	1,060	0.98				8.00	.00102
	90	17.5		1.38	.000017			4.90	.00289
	100	19.3	1,063	2.96		35,000	18	2.40	.0040

Notes: (1) 1 watt per cm. per deg. C. = 0.239 cal. per sq. cm. per cm. per sec. per deg. C.
(2) at 0 deg. C.

WALDES TRUARC RETAINING RING

U. S. PAT. RE-18,148

EXTERNAL TYPE NAS-51

INTERNAL TYPE NAS-50

Waldes Truarc expands or contracts without distortion and without permanent set, fitting tight all around the groove. It offers important advantages over shoulders, nuts, collars, etc., for all thrust-load fixings in shaft and housing applications. It saves space, weight, assembly time and machining costs. Waldes Truarc presents a significant advance in retaining rings, well worth your thorough investigation. We will gladly furnish samples and full data for tests, upon request.

Internal type National Aircraft Standard 50.
External type National Aircraft Standard 51.

WALDES KOHINOOR, INC. Long Island City 1, N.Y.

Canadian Representatives . . . Pronco Progress & Engineering Corporation, Ltd. • 72-74 Stafford Street, Toronto

SHEET NUMBER . . . . . D-31 (cont'd)
CLASSIFICATION . . . . . Materials
SUB CLASSIFICATION . . . . . Contact Alloys

resistance tending to give better performance at high current densities, dependent on kind of material, condition, and shape of surfaces and pressure; (8) *hardness and toughness* preventing excessive wear, especially when pressure and frequency of operation are present; and (9) *non-oxidizing*, preventing excessive heating of contact surfaces due to resistance of oxide film.

Ideal contact material would have high melting point, specific heat, thermal conductivity, hardness, toughness, and wear resistance. It should also have low electrical resistance, temperature coefficient of resistance, contact resistance, and coeffiicient of expansion, in addition to non-oxidizing properties and low final cost.

Important current characteristics in contact selection are: Amount and type of current, frequency of operation, voltage to be interrupted, speed of opening and closing, contact pressure, ambient temperature, and atmosphere in which contacts operate. Circuit characteristics—inductive, restrictive, or capacitive—should be considered, also methods used for closing contacts, whether gravity, mechanical, or magnetic. In the field of metallurgy there have been developed new types of sintered materials incorporating highly desirable properties and giving greatly improved contact performance.

Alloy	Per-cent	Specific Gravity	Melting Point	Thermal Conductivity	Coeff. Linear Expan.	Ultimate Tensile Strength	Brinell Hardness Number	Specific Resistance	Coeff. Elec. Resistivity
			Deg. C.	Watts(1) cm.deg.C. at 20 deg. C.	Per deg. C.	Lb./in.²	10 mm. ball 500 kg. load	Microhm-cm. at 20 deg. C.	Per deg. C. at 20 deg. C.
Ag-Pt	0	10.5	960	4.19		20,000(4)	36(4)	1.62	.0038
%	10		1,040	1.00		29,000 "	65 "	9.1	.00077
Pt	20		1,120	0.60		40,000 "	72 "	18.1	.00050
	30		1,180	0.31		52,000 "	90 "	29.0	.00031
	40		1,350			55,000 "	118 "	32.0	.00026
	50		1,450			85,000 "	140 "	57.0	.00030
	60		1,530		.000014	105,000 "	170 "	60.0	.00040
	70		1,570			120,000 "	185 "	55.0	.00050
	80					128,000 "	200 "	53.0	.00050
	90					80,000 "	170 "	50.0	.00055
	100	21.45				35,000 "	40 "	10.5	.0030
Pt-Ir	0	21.45	1,755	0.690		80,000(3)			
%	5	21.474					170(3)	17.82(2)	.00188(2)
Ir	10	21.55	1,800	0.310(2)	.0000088	106,000 "	220 "	23.05 "	.00126 "
	15	21.594		0.234(2)			280 "	26.9 "	.00102 "
	20		1,840	0.176(2)	.0000082	130,000 "	330 "	29.5 "	.00081 "
	30		1,900			200,000 "	370 "	32.9 "	.00058 "
	35		1,930			213,000 "	400 "	36.9 "	.00058 "
Pt-Ru	0	21.45	1,755	0.690		35,000	42		.003
%	3					42,000			
Ru	5					60,000	130	31.5	.00085
	10					85,000	190	43.0	.00083
Pd-Cu	0	12.0	1,555			30,000	49	11.0	
%	10	11.7	1,460			75,000	90	24.0	
Cu	20	11.4	1,370			90,000	110	42.0	
	30	11.1	1,300			95,000	120	55.0	
	40	10.6	1,220			90,000	122	35.0	
	50		1,180			85,000	120	29.0	
	60		1,170			80,000	110	21.0	
	70		1,150			70,000	95	16.0	
	80		1,140			60,000	85	12.0	
	90		1,120			50,000	50	7.0	
	100	8.89	1,083			35,000	45	1.69	

Notes: (1) 1 watt per cm. per deg. C. = 0.239 cal. per sq. cm. per cm. per sec. per deg. C. (2) at 0 deg. C. (3) work hardened. (4) quenched from 800 deg. C.

(Courtesy Callite Tungsten Corp.)

COAST GUARD'S HYDRAULIC Rescue Hoist

...engineered and built by VICKERS

This Sikorsky Helicopter equipped with a Vickers Hydraulic Rescue Hoist is used for rescuing personnel from the water or any other inaccessible place. Here is an application that well illustrates many of the important advantages of Vickers Hydraulic Power and Control.

The Vickers hydraulic motor for driving the winch has the high starting torque necessary. It will hold without clutches or brakes and can be stalled indefinitely without damage. It has easily controllable variable speed and smooth operation. It has instant starting, stopping or reversal due to very low inertia of the moving parts. It has simplicity of design and installation. It is rugged and dependable yet has minimum weight. These are all characteristics extremely useful on many other aircraft applications.

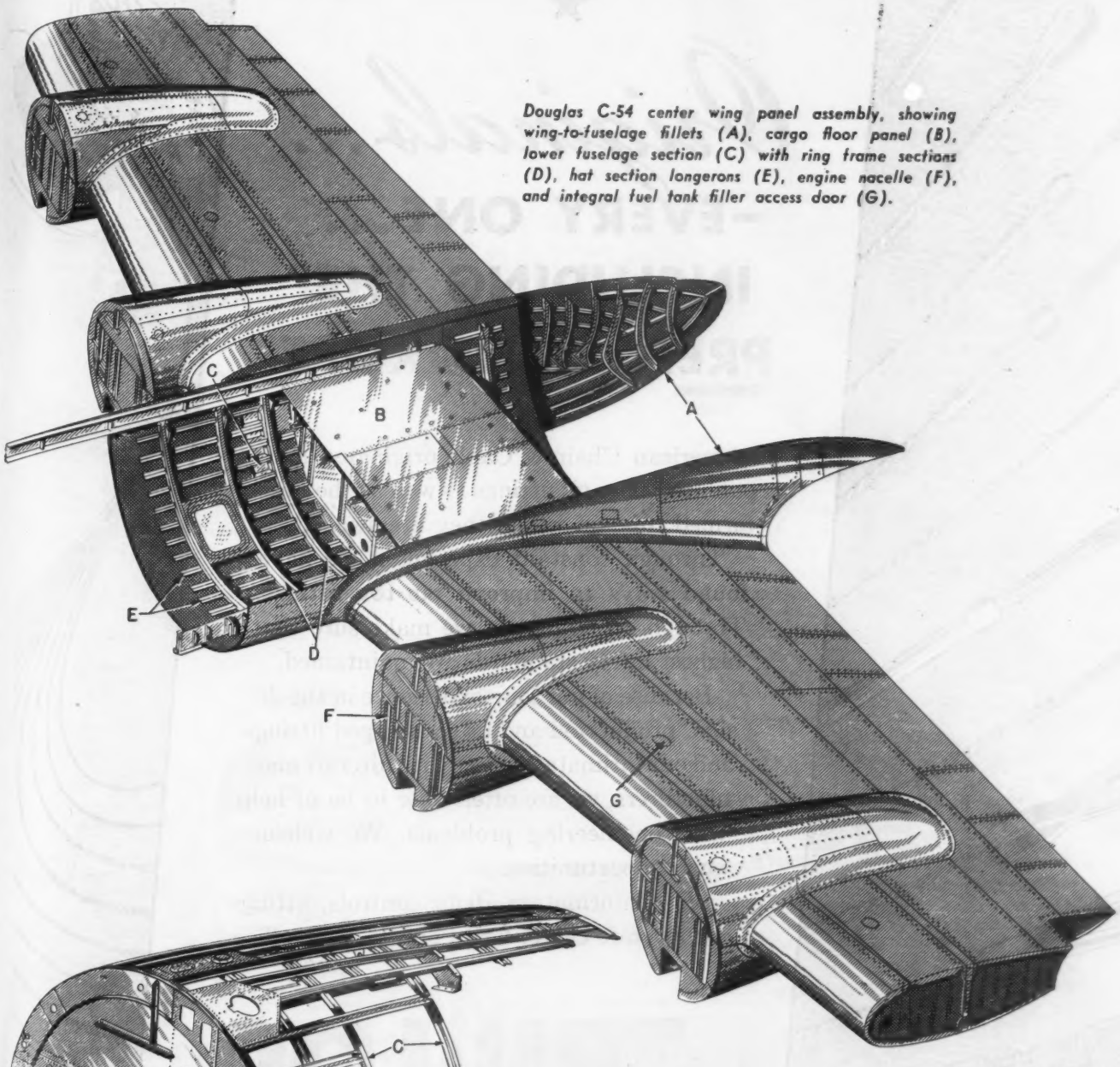
VICKERS AIRCRAFT PISTON TYPE HYDRAULIC PUMP AND MOTOR are the heart of the Hydraulic Rescue Hoist. Their overall efficiency and horsepower/weight ratio are exceptionally high; they occupy little space. A wide range of models is available.

VICKERS Incorporated

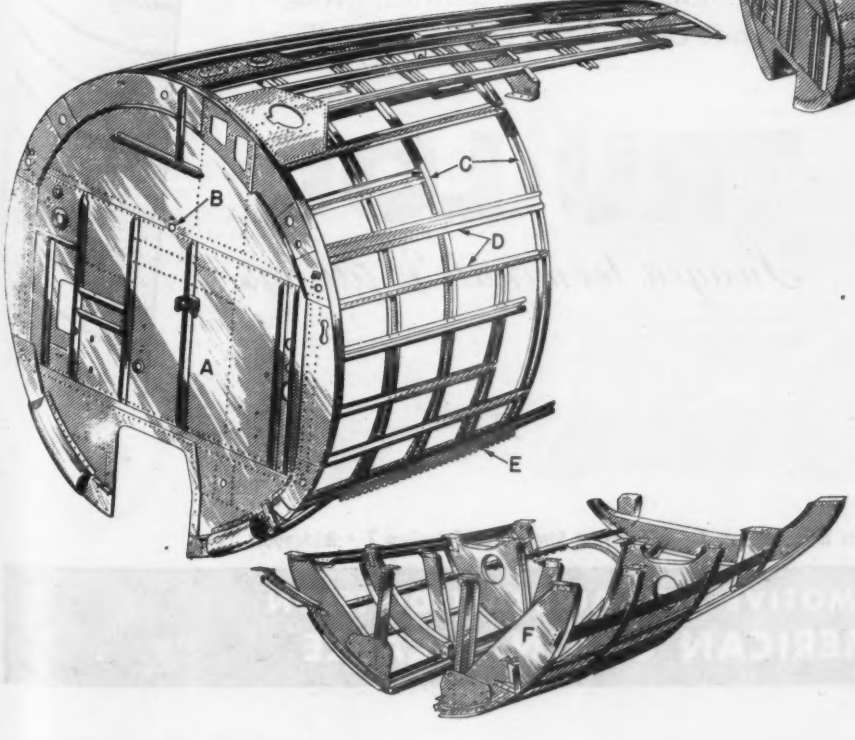
1462 OAKMAN BLVD. • DETROIT 32, MICHIGAN

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

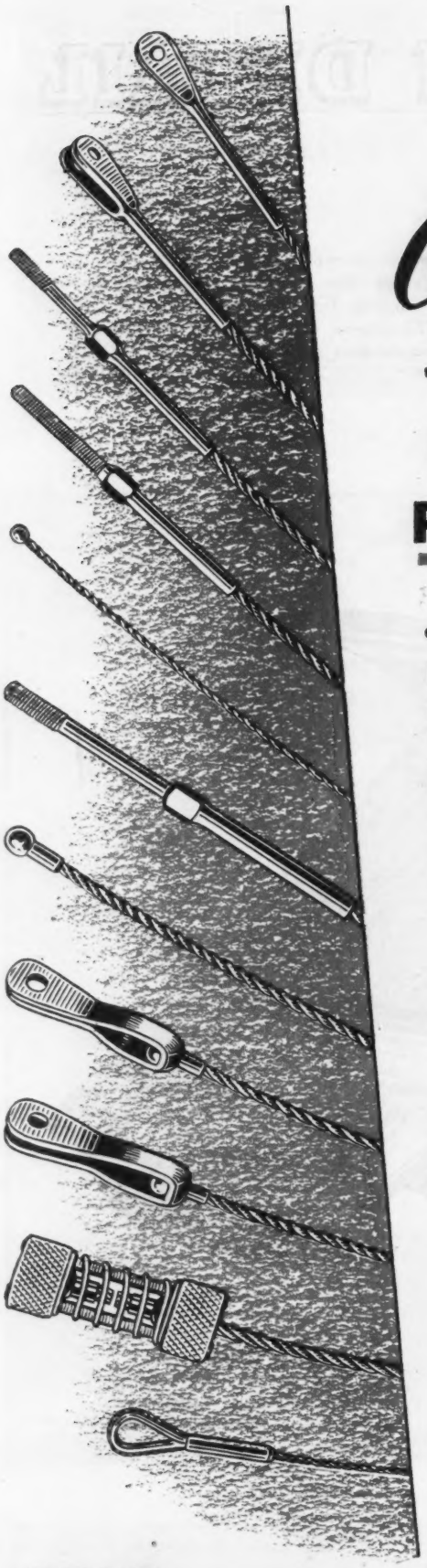
AVIATION'S SKETCHBOOK OF DESIGN DETAIL

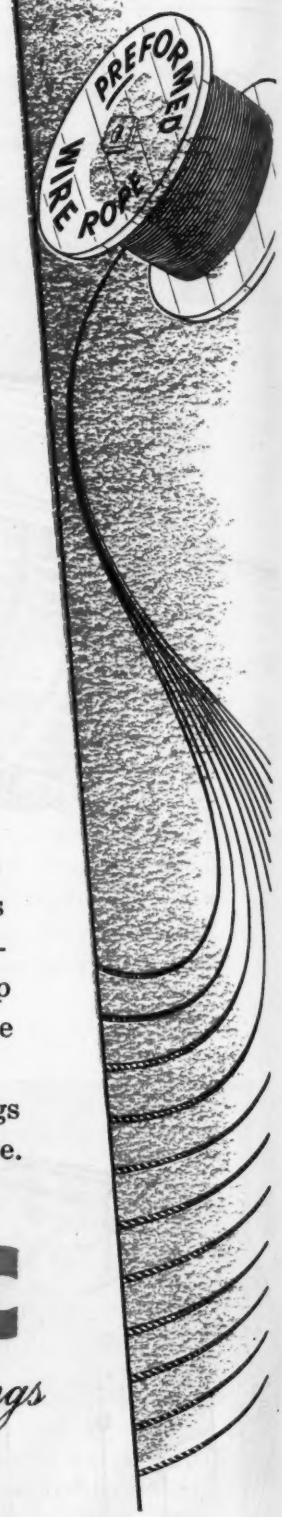


Douglas C-54 center wing panel assembly, showing wing-to-fuselage fillets (A), cargo floor panel (B), lower fuselage section (C) with ring frame sections (D), hat section longerons (E), engine nacelle (F), and integral fuel tank filler access door (G).



Inboard nacelle structure of C-54, with skin removed to show stainless steel firewall (A) with holes (B) to receive bolts of interchangeable engine mounts, frames (C) and longerons (D) made of rolled aluminum alloy hat sections, main wheel door hinge (E), and lower aft nacelle and landing gear strut fairing (F).





★

Originals...

—EVERY ONE... INCLUDING THE PREFORMED ROPE

• American Chain & Cable originated and patented **TRU•LOC** fittings as well as the preformed rope on which they are swaged.

Through constant experiment we have found ways to improve **TRU•LOC** fittings. Through constant test we make sure that highest safety standards are maintained.

Because of our long experience in the design, production and use of swaged fittings and our intimate contact with aircraft manufacturers, we are often able to be of help with engineering problems. We welcome such opportunities.

For information about controls, fittings or aircraft cable, write our Detroit office.

TRU·LOC

Swaged terminals & fittings

★

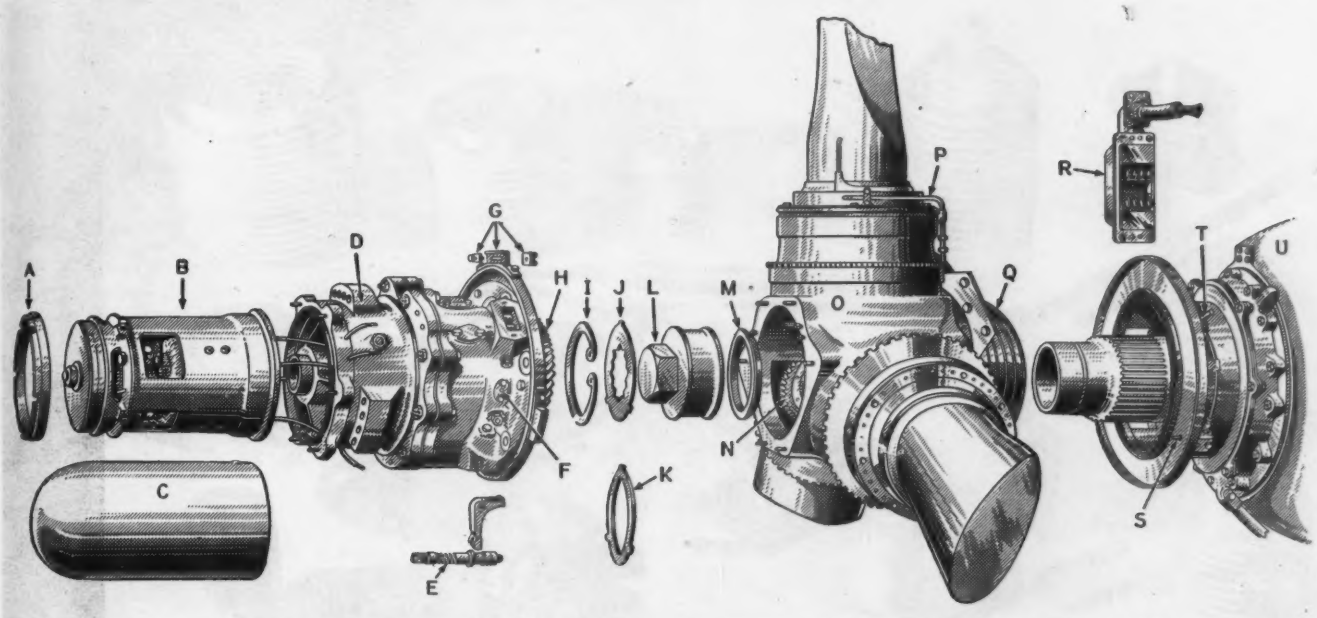
ACCO

6-235 General Motors Bldg., Detroit 2 • 695 Bryant Street, San Francisco 7 • Bridgeport, Conn.

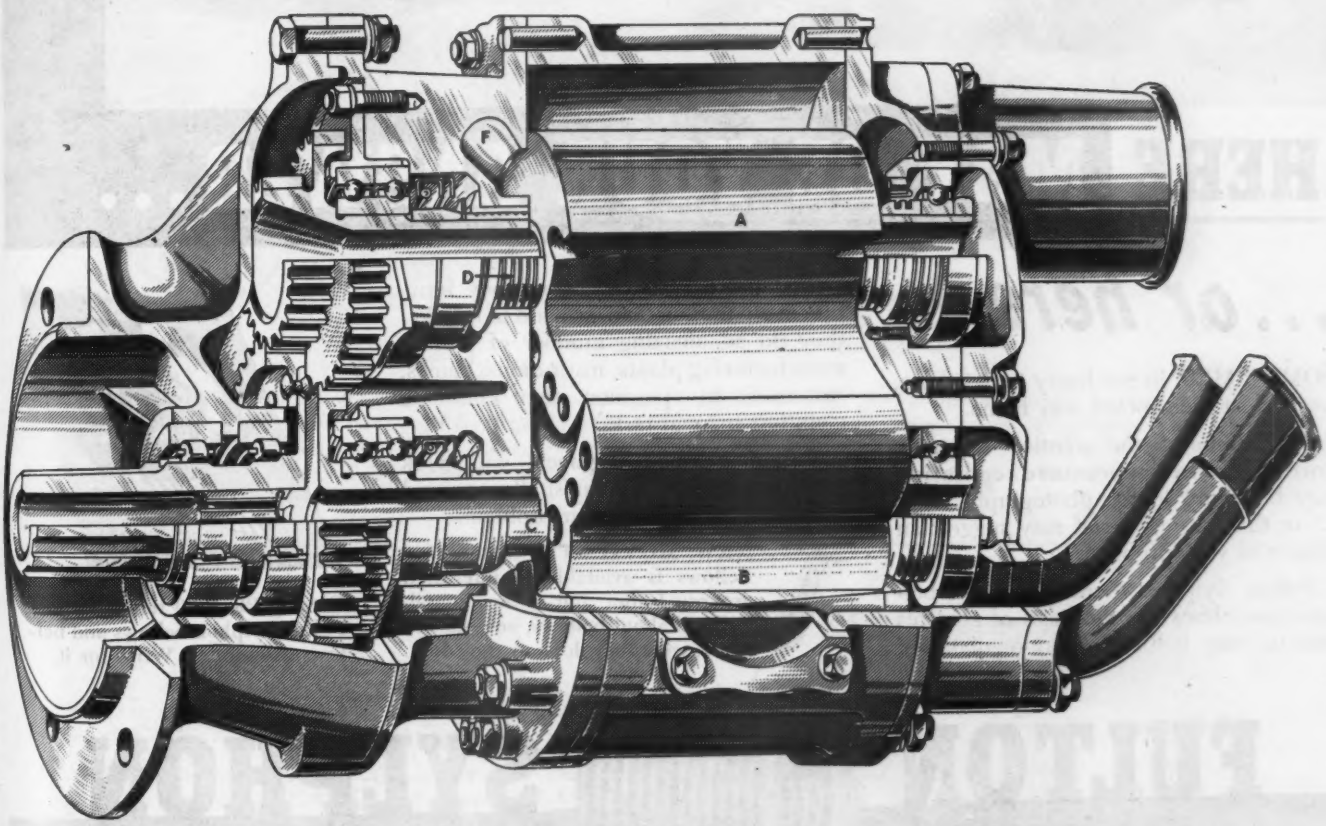
AUTOMOTIVE AND AIRCRAFT DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

In Business for Your Safety



Exploded view of Rotol electric constant speed propeller, showing motor retaining nut (A); electric motor (B); motor cover (C); reduction gear (D); cam operated cutout (E); mechanical high pitch stop (F); bearing housing lock (G); driving bevel gear (H); circlip (I); locking plate (J); extractor ring (K); hub retaining nut (L); cone (M); blade bevel (N); propeller hub (O); de-icer gear (P); sliprings (Q); brush gear (R); slinger ring feed pipe (S); slipring housing (T); and finally (extreme right) the reduction gear housing installation is shown at (U).



Aircraft cabin supercharger developed by Rotol Ltd., designed to maintain pressure equivalent to 10,000 ft. up to altitudes of 40,000 ft. Engine-driven, supercharger is of displacement type, with two rotors (A) and (B) interacting, but not touching each other since no rubbing or sliding parts (which would necessitate lubrication) can be allowed within chamber. Since, however, spindles (C) and (D) and the gear trains must be lubricated, pumping chamber is sealed off by annular space and air is bled through ports, such as at (F), to create "one way traffic of air" and thus assure draining out of any oil. Numerous other details of unit's structure may be noted in this cutaway.

HERE MAY BE YOUR ANSWER...

...or here

SOMETIMES, in our hurry to get there, we neglect the shortest way home.

For example—the solution to many bottlenecks in temperature regulation may be found in the photograph above ... or this message itself may suggest an answer to your problem.

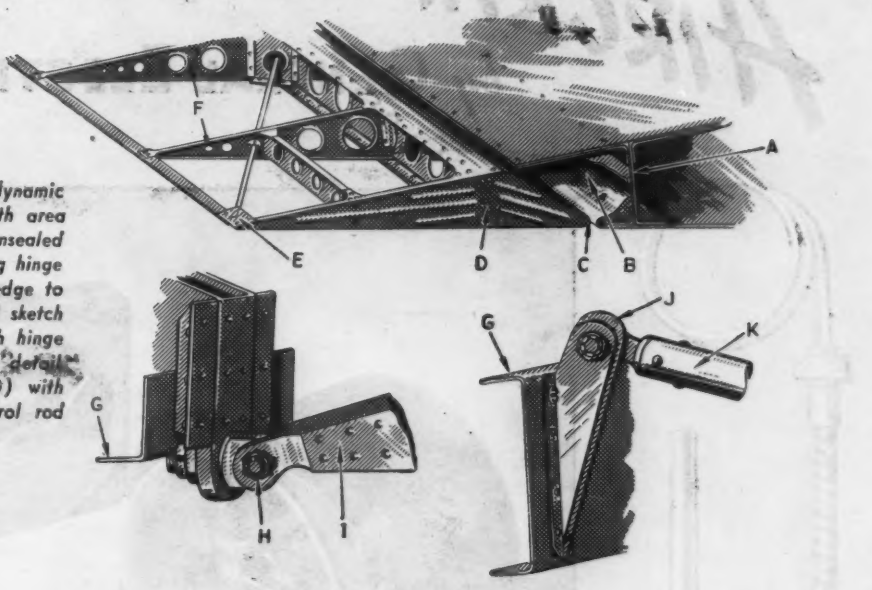
Fulton Sylphon thermostats and bellows assemblies are the basis of controls used in every industry. They regulate oil, water, and air temperatures; they function in engines on land, sea and in the sky; they do an amazing number of jobs in manufacturing plants, institutions, homes. Automatic in operation, they eliminate countless manual tasks.

Fulton Sylphon engineers will work with you, help find the most effective and economical answer to your problem.

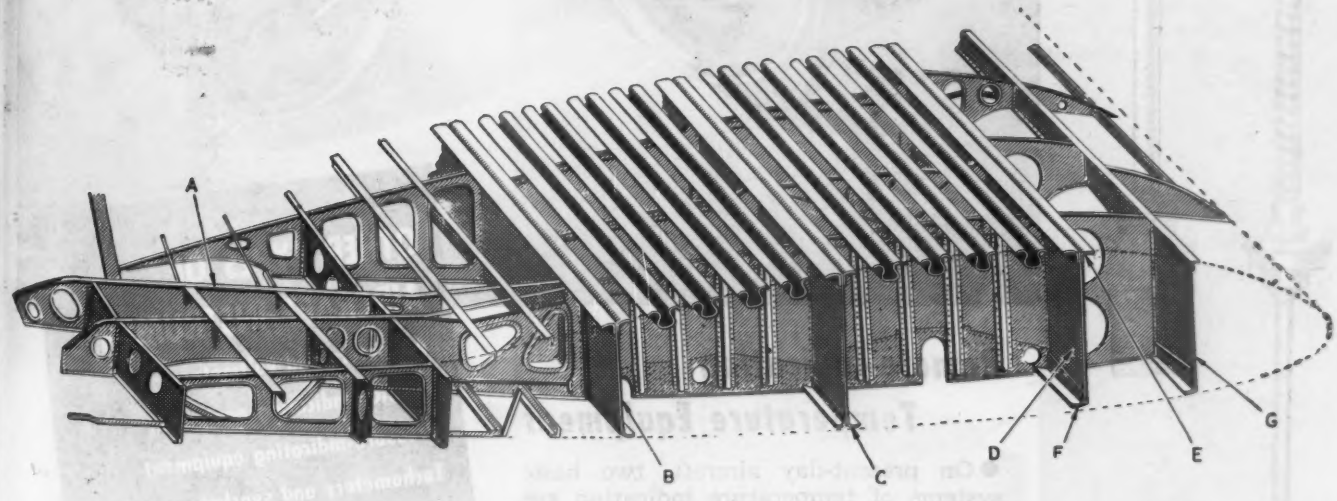
NEW MOVIE—The Story of a Bellows is available to interested groups. 16mm and 35mm sound. Tells all about bellows, how they're made, what they do, how they do it.

Catalog PK-1300 tells all about Fulton Sylphon bellows and bellows assemblies. Write for it.

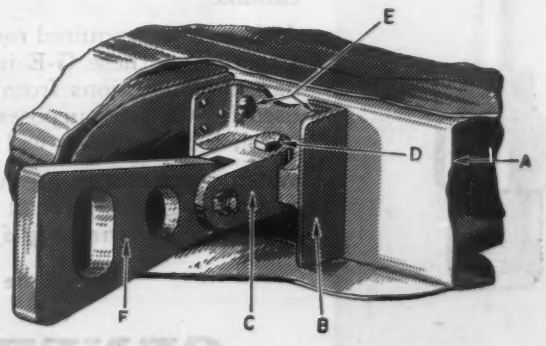
FULTON SYLPHON



Aileron of the Jap Oscar fighter is of aerodynamic balanced type, attached to rear spar (A) with area (B) designed to give aileron edge (C) an unsealed operation. Aileron spar at (D) is located along hinge line. (E) shows gusset for attaching trailing edge to rib, and typical ribs are shown at (F). Detail sketch (left in group) shows aileron spar at (G) with hinge fitting at (H) and wing fitting at (I). And detail sketch (right in group) shows aileron spar (G) with attachment fitted to aileron at (J) and control rod link at (K).

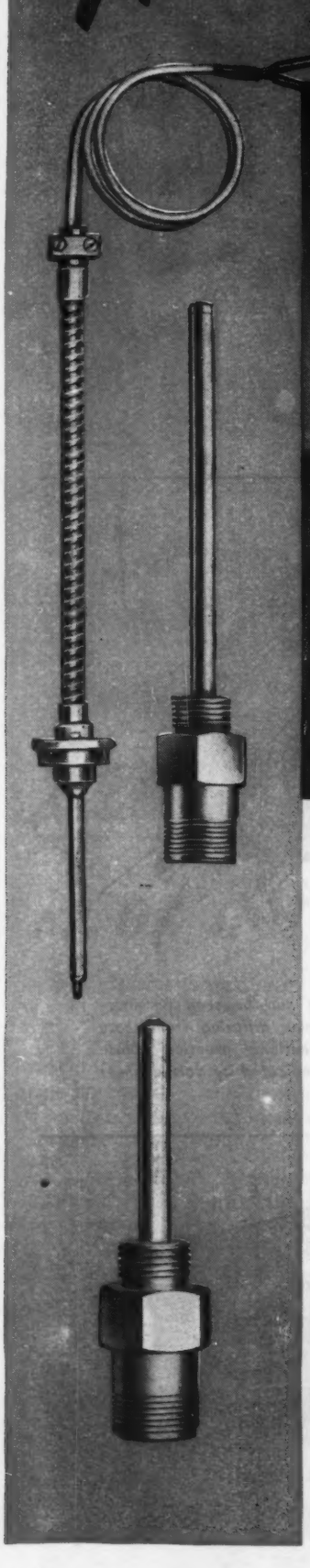


Cutaway of Oscar wing center section, on which fuselage meets along rib (A). Rear, center, and front spars are shown at (B), (C), and (D), respectively. Note T-section (E) and angle (F) which, instead of being straight along top surfaces adjoining wing, are formed in an arc with only one part tangent to skin. Similar arc shape can be seen on spanwise rolled stringers along top surface, differing from those aft of rear spar, which follow conventional practice. Nose rib spar for D-section leading edge (indicated by dotted lines) is located at (G).



Detail of Oscar elevator hinge assembly, with elevator spar shown at (A), and hinge fitting (B), into which hinge support (C) is bolted by through-bolt (D). Complete fitting is attached by bolts (E). Hinge fitting from stabilizer is at (F).

AIRCRAFT INSTRUMENTS
by GENERAL ELECTRIC



OTHER TYPES OF AIRCRAFT INSTRUMENTS

- Ammeters and voltmeters
- Position-indicating equipment
- Pressure-indicating equipment
- Tachometers and synchroscopes
- Liquid-level-indicating equipment
- Remote-indicating compasses
- Electric gyroscopes

Remote-indicating Temperature Equipment

● On present-day aircraft, two basic systems of temperature indication are widely used. They are the *ratio-type,* which is used for the indication of oil temperature, carburetor-air temperature, and outside-air temperature, and the *thermocouple-type,* which is used for the measurement of exhaust-gas temperature and for other special applications.

Although the required range of each of these indications is different, the construction of these G-E instruments is such, even to the extent of omitting names of functions from the scaleplates, that a single design can often be used for various purposes. However, when special requirements are encountered, G-E engineers will be glad to work with you on the specific problem.

When our facilities are no longer needed for war, we will continue to build many designs of aircraft instruments to meet your needs. *General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can—and *keep all you buy*

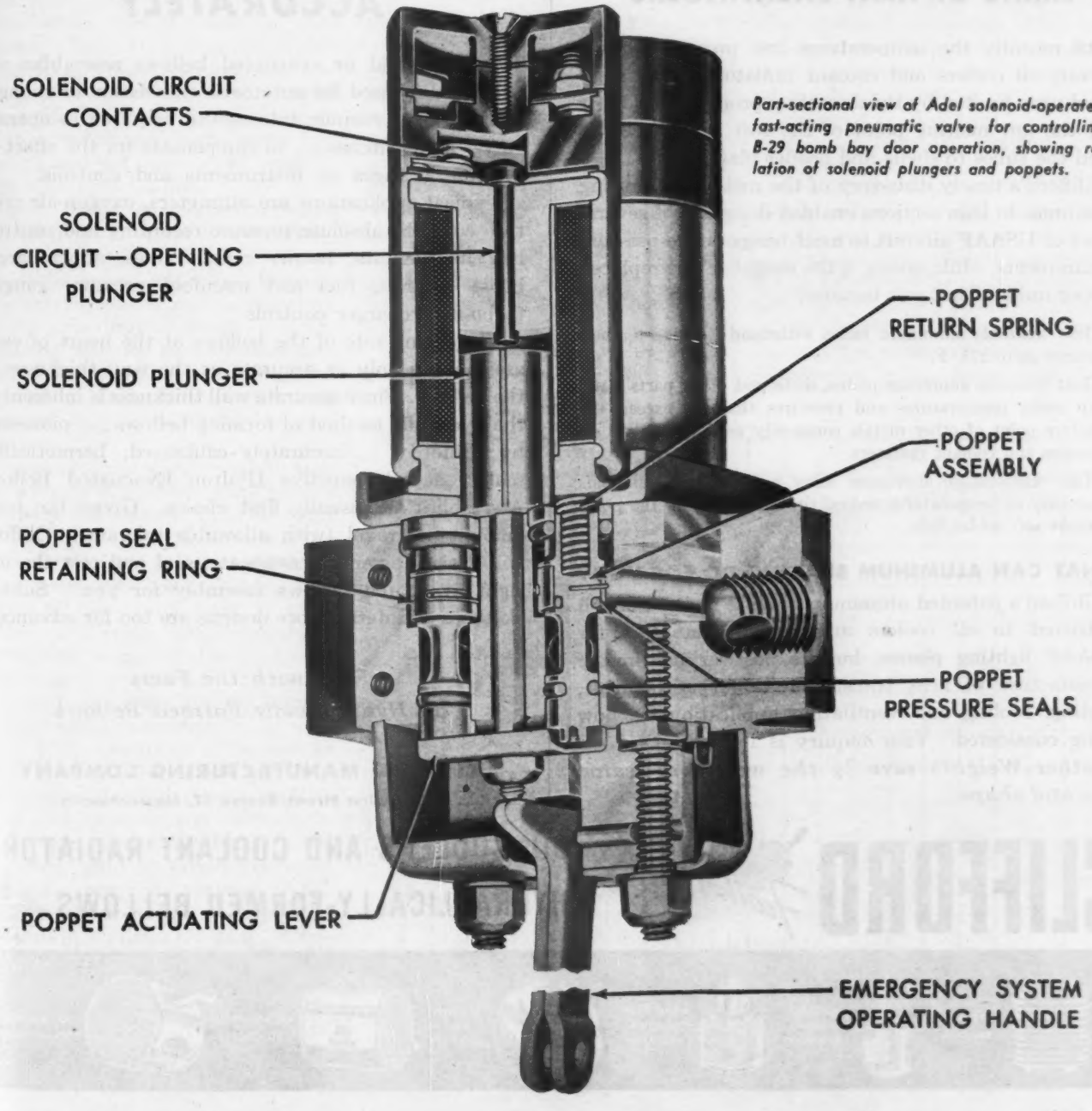
GENERAL ELECTRIC

607-2-6399

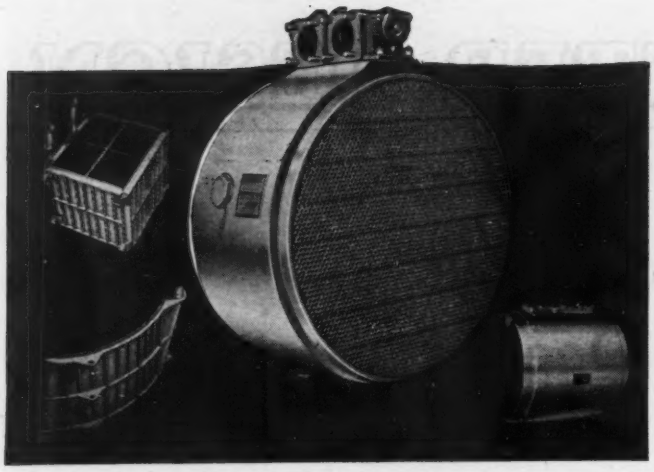
How Pneumatic Valve Solved Split-Second Bomb Door Operation

USED TO CONTROL the operation of the bomb-bay doors, the Adel Precision Products Corp.'s fast-acting solenoid-operated pneumatic valve is instrumental in making B-29's more effective, contributes to safety of plane and crew, and saves substantial dead weight on these giant bombers.

The longer it takes to open bomb bay doors, the more time is allowed enemy anti-aircraft gun crews to calculate range, adjust automatic gun directors, and open fire on the bombers. If the enemy gunners are aware that a bomber is on its target run, they know the pilot cannot resort to devious tactics in an attempt to confuse their aim. Accordingly, they watch for the



Part-sectional view of Adel solenoid-operated fast-acting pneumatic valve for controlling B-29 bomb bay door operation, showing relation of solenoid plungers and poppets.



HOW ALUMINUM BRAZING RAISES SAFE TEMPERATURE-PRESSURE LIMITS OF HEAT EXCHANGERS

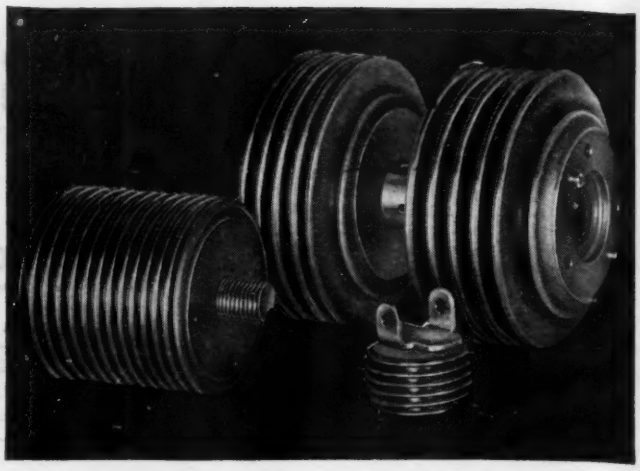
Until recently the temperatures and pressures which aircraft oil coolers and coolant radiators could withstand were limited by the annealing property of copper and the low melting point of the soft solder used to bond the tubes to shells and header plates.

Clifford's timely discovery of the method of brazing aluminum in thin sections enabled designers of several types of USAAF aircraft to meet temperature-pressure requirements, while saving ⅔ the weight of the replaced copper units. That was because:

1. Heat treatable aluminum tubes withstand working temperatures up to 275° F.
2. Heat treatable aluminum plates, shells and other parts stand up under temperatures and pressures that far exceed the failure point of other metals commonly used in aircraft oil coolers and coolant radiators.
3. High temperature aluminum alloy bonding material holds securely at temperatures several times higher than the point where soft solder fails.

WHAT CAN ALUMINUM BRAZING DO FOR YOU?

Clifford's patented aluminum brazing method is still restricted to oil coolers and coolant radiators for USAAF fighting planes; but its postwar use in the manufacture of heat transfer units for automotive, heating, cooling and ventilating applications is now being considered. Your inquiry is invited. *Clifford Feather-Weights save ⅔ the weight . . . same size and shape.*



SYNCHRONIZING MOTION WITH BAROMETRIC CHANGES *ACCURATELY*

Today, aneroid or evacuated bellows assemblies are being widely used for automatic translation of changes in altitude or vacuum into motion required to operate valves and switches . . . to compensate for the effect of pressure changes on instruments and controls.

Typical applications are altimeters, oxygen-air mixture controls, absolute pressure recording and controlling instruments, header relief valves, supercharger boost controls, fuel and manifold pressure gauges, turbo-supercharger controls.

The spring rate of the bellows at the heart of each assembly is only as accurate as the wall thickness of the bellows. Since accurate wall thickness is inherent in the hydraulic method of forming bellows . . . pioneered by Clifford . . . accurately-calibrated, hermetically-sealed, acutely-sensitive Hydron Evacuated Bellows Assemblies are usually first choice. Given the total amount of travel (with allowable tolerance) Clifford will design, assemble, evacuate, seal and test the one right evacuated bellows assembly for you. Submit sketches and data before designs are too far advanced.

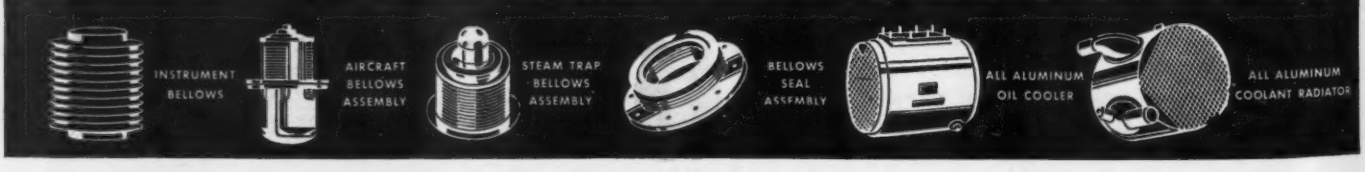
First with the Facts
on Hydraulically-Formed Bellows

CLIFFORD MANUFACTURING COMPANY
561 E. First Street, Boston 27, Massachusetts

CLIFFORD *Feather-Weight*

OIL COOLERS AND COOLANT RADIATORS
HYDRAULICALLY-FORMED BELLOWS

HYDRON Metal Bellows



bomb-bay doors to open—a sign that the bomber is on target run, maintaining a steady course at constant speed for several seconds at least. In the past, the loss of many craft has been attributed to slowly opening doors which lengthened the target run.

Original B-29's required as much as 20 sec. or more for opening the bomb compartment doors. Even when pilots tried to reduce the enemy's advantage by delaying the opening of the doors until the last moment, still too much time was allowed for enemy guns to become effective. It became necessary, therefore, to counteract the situation by providing means whereby the time interval required for opening the doors would be greatly reduced.

The ATSC requested Boeing engineers to consider the problem, and various methods for moving the doors were studied to determine a system that would do the job in a split second. Calculations and preliminary tests showed that a pneumatic system offered encouraging possibilities, provided that a control valve, among other pieces of special equipment, could be designed to operate the system fast enough and yet possess the requisite degree of dependability.

After Boeing engineers determined the feasibility of using compressed air to energize the system, Adel engineers were presented with the problem. Engineering studies made preparatory to the experimental design program called for adopting an electrically controlled valve based on the previous design of a similarly controlled high pressure fluid valve already in production.

Solenoid-actuated valves of this type are normally operated by a low voltage circuit to the solenoids or, in the event of electrical system failure, may be manually operated by cables connected to the emergency handle. Being connected to the control point by small cables or wires, solenoid-operated valves may be placed close to associated related equipment.

Performance tests on the experimental valves exceeded by a wide margin the conditions to be met in actual service. One of the tests consisted of heating the valve assemblies in an oven for seven days continuously at a temperature of 160 deg. F. while subjecting them to various operating conditions, using air pressure at 675 psi.—greatly in excess of the system pressure in service (175 psi.). Pressure drop through the valve was measured against variations in volume of air passing through it, and was found to be within satisfactory limits.

Operating the emergency handle, torque loads were measured with the valve controlling air pressures up to 450 psi., the load being 18 in.-lb. at normal temperatures and 22½ in.-lb. with temperature lowered to −65 deg. F. Both values indicated an operating load considerably under specified maximum allowable.

Electrical tests were made to determine current consumption and minimum voltage required to operate the valve in 1/10 sec. when controlling the air at 450 psi. Required were 8 amp. at 10 v. to actuate the solenoid and open the valve, and 0.20 amp. to hold it—indicating a very small current consumption, especially in view of the wide difference between the test pressure (450 psi.) and actual system pressure (175 psi.).

The valves were also subjected to a life test consisting of on-and-off operation 60 times per min. for 20,000 cycles. Air flow was maintained at 6 cfm. at 450 psi. test pressure, and no leakage was evident at any time. All moving parts, when checked at the close of the run, were well within allowable dimensional tolerances, showing little or no wear. No malfunctioning was caused by 50 hr. of vibration at frequencies of 600 to 3,300 cycles per min. at $\frac{1}{16}$ in. amplitude.

Cold tests made over a period of 72 hr. at various temperature levels—lowest being −65 deg. F.—had no detrimental effect on the valves, which were operated continually under maximum test pressure.

Sealing the air at 450 psi. presented a problem in design, necessitating a departure from methods usually employed with valves for hydraulic fluid, and the answer was found in the form of a poppet incorporating "O" ring seals.

The change-over from the original motor-driven bomb-bay door system to pneumatic actuation resulted in a weight-saving of 200 lb.—the equivalent of more than 33 gal. of fuel. Action of the doors was stepped up so they would unlatch and fully open in less than 7/10 sec., whereas former electrical actuation required over 20 sec. Closing the doors originally required 30 sec., while with the new installation they are closed and latched in 1 2/5 sec.

The door actuating system consists of an electrically driven air compressor specifically built for aircraft application; reservoir for storing a sufficient volume of compressed air to move the doors through four cycles of operation; remotely controlled valve for each pair of double-acting actuating cylinders; pneumatic door latches; an air regulating valve for maintaining system pressure at 175 psi.; and miscellaneous fittings and electrical circuit devices.

Each solenoid in the valve is double wound, both coils being connected in parallel and producing an electromagnetic force of sufficient magnitude to snap the plunger into retracted position in a fraction of a second. Moving up, the plunger unseats a pair of poppets and breaks the circuit to one of the solenoid coils, leaving only the

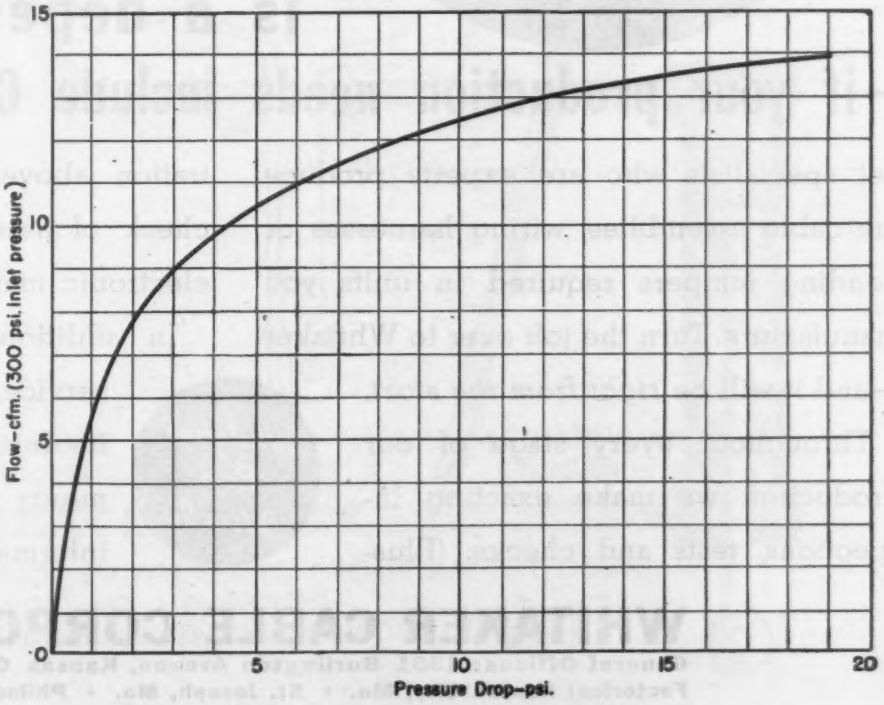


Chart of pressure drop plotted against air flow through pneumatic control valve.

RIGHT from the START!

You'll find WHITAKER is a dependable source —if your production needs include CABLE ASSEMBLIES

Let specialists who are experts produce the cable assemblies, wiring harnesses or bonding jumpers required in units you manufacture. Turn the job over to Whitaker —and it will be *right from the start.*

Throughout every stage of our production we make exacting inspections, tests and checks. (Illustration above shows positive continuity check of assemblies being made for an electronic manufacturer).

In addition to an engineered wiring service, Whitaker also offers a quality line of standard cable requirements . . . Write us for complete information.

Whitaker Can Wire It

WHITAKER CABLE CORPORATION

General Offices: 1301 Burlington Avenue, Kansas City 16, Missouri
Factories: Kansas City, Mo. • St. Joseph, Mo. • Philadelphia • Oakland

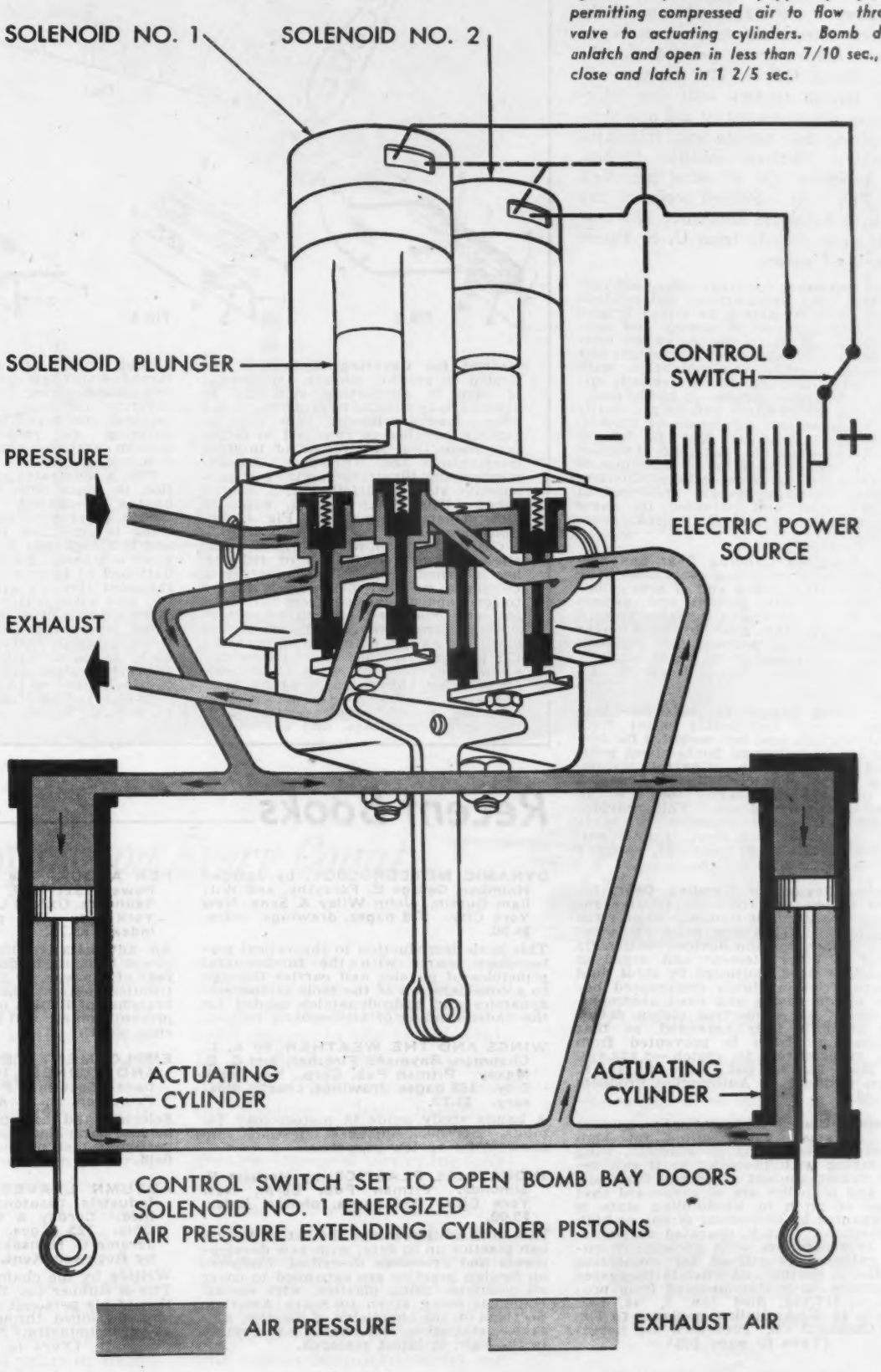
1920—Silver Anniversary—1945

holding coil energized, which is enough to hold the plunger against the compression of the two poppet springs.

Unseating the poppets allows compressed air to flow through the valve to the actuating cylinders to open or close the bomb bay doors, depending upon the position of the control switch connecting one or the other solenoid to the battery circuit.

Initial current demand of 12 amp. at 24 v. is only momentary, and is reduced to 0.20 amp. necessary to hold in the plungers after one of the two coils is cut out immediately upon retraction of the plunger.

Schematic view of pneumatic valve. Electromagnetic force of solenoid coils affects plunger retraction in fraction of second, unseating poppets, breaking circuit in one of coils to allow holding coil to retain plunger against compression of poppet springs, and permitting compressed air to flow through valve to actuating cylinders. Bomb doors unlatch and open in less than 7/10 sec., and close and latch in 1 2/5 sec.



REVIEW OF PATENTS

By A. HARRY CROWELL

Registered Patent Lawyer

FOLLOWING are digests of some of the more interesting recent patents on aviation developments granted by the U. S. Patent Office. Mr. Crowell will gladly furnish readers with free information on approximate cost and procedure in applying for patents and trademark registration. Address inquiries to him, care AVIATION, 330 W. 42nd St., New York City (18). Printed copies of any of patents listed are obtainable at a cost of 10c each, directly from U. S. Patent Office, Washington.

Cockpit Enclosure for single-place aircraft comprises two symmetrical independent doors capable of acting as struts hinged together along peak of canopy and normally attached by releasable swivel connection (to arch apexes of windshield and turtleback cover) in combination with pair of latching mechanisms manually operable from either outside or inside cockpit. Thus entire hatch can be automatically released by airstream.—2,375,924, filed Nov. 11, '42, pat. May 15, '45, S. Johnson assignor to Republic Aviation Corp. To assure adaption of principles of this invention to large-scale production, simplified embodiments are presented in 2,375,925, filed and patented on same dates, S. Johnson and E. Schenk, same assignee.

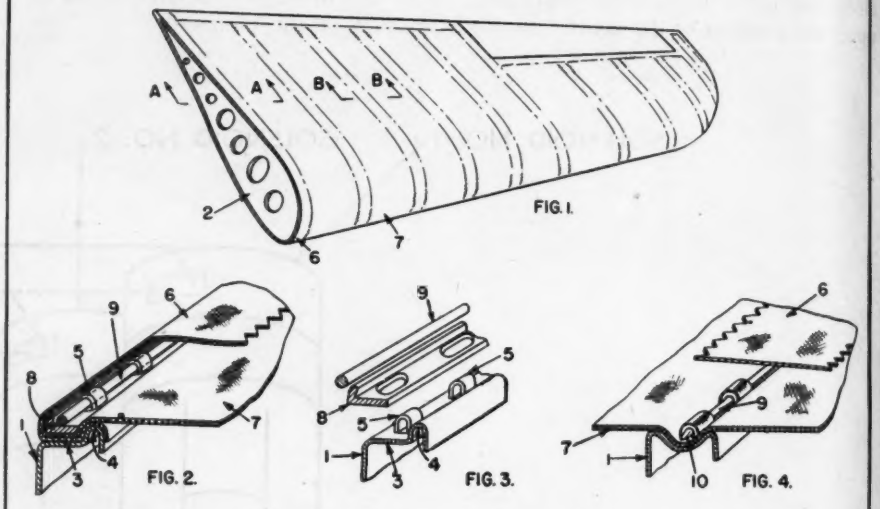
Newly Designed Landing Gear has arm pivoted on, and extending down from body of plane, so that lower end of arm comes into contact with ground and swings rearward and upward as it trails, upward movement causing gear to be brought down into landing position, and dropping of arm causing gear to be raised.—2,376,374, filed June 1, '42, pat. May 22, '45, R. H. Miles.

Rotary Wing Control provides for blade flapping pivots appreciably offset from axis of rotation, and hub mounted for free tilting (as by universal joint) about point located on hub axis. Control system, having servo characteristics, is coupled with pilot's flight control for effecting control in pitch and roll. This provides periodic differential changes of blade pitch.—2,376,523, filed Sept. 4, '42, pat. May 22, '45, K. P. Synnestvedt, assignor to Autogiro Co. of America.

Damping Device for Landing Gear, intended to prevent excessive relative rotational movement of elements when strut is compressed, embodies fixed abutment on one element, piston device rotationally coupled to other element and urged in direction of fixed abutment by strut fluid pressure, friction clutch compressed between piston device and fixed abutment, and means for supporting piston device when strut is fully extended, so that pressure on piston is prevented from being transmitted to clutch.—2,376,678, filed Mar. 15, '43, pat. May 22, '45, S. Foster, assignor to Automotive Products Co., Ltd.

Propeller Blades automatically assume pitch of small value suited for high efficiency when acting as windmill, wing cooperating with propeller so it can recover fullest amount of energy from air. Flap and propeller are so connected that change of pitch to windmilling state is accompanied by movement of flap to high lift position. Clutch, operated automatically in accordance with pressure in engine cylinder, is utilized for connecting propeller to engine, and when latter ceases to function, it is disconnected from propeller.—2,377,886, filed Jan. 2, '40, pat. June 5, '45, E. A. Stalker, assignor to The Dow Chemical Co. Presented are means

(*Turn to page 265*)



Method for Covering Airfoils is intended to provide smooth attachment of skin to supporting structure to substantially eliminate projections and afford means whereby skin may be quickly installed or removed to facilitate inspection and repair of internal mechanisms and structures. In accompanying illustration, Fig. 1 is perspective view of airfoil; Fig. 2, section taken along A-A; Fig. 3, exploded view of part in Fig. 2; and Fig. 4, section along B-B.

Capstrip (1), shown in form of metal angle, is secured to top of rib (2), has inturned flange (3) terminating in U-shaped member (4), and is lanced to form spaced eye-members (5). Tape (6), stretched and pierced to receive eye-members, is temporarily secured to capstrip, as by gluing, and covering (7) is also stretched and temporarily secured to face of wing, with side edges being pierced to lie above tape. L-shaped retainers (8), placed over covering, permit clearance for openings in eye-members, and flexible retaining rods or strands (9) are threaded through eyes to lock retainer and hold covering in place. Edges of covering and tape are stretched over retainer and doped to outer portion of covering to present substantially smooth cambered surface of high aerodynamic efficiency.

Fig. 4 illustrates method of application to inner ribs, with capstrip (1) having U-shaped depression, also lanced to provide eye-member. Covering is stretched taut over capstrip and is forced into depression to obtain more tautness. Flexible retaining rod, flattened to form cutting edge (10), is threaded through eyes, pierces covering, and holds it tight against edges of depression. Tape is then doped in place to provide substantially uninterrupted flush surface. Tape is taken up by loosening with solvent, retaining rods withdrawn, and covering removed to provide access to structure interior. —2,375,951, filed Mar. 21, '42, pat. May 15, '45, R. Simon, assignor to Briggs Mfg. Co.

Recent Books

DYNAMIC METEOROLOGY, by Joergen Holmboe, George E. Forsythe, and William Gustin. John Wiley & Sons, New York City. 378 pages, drawings, index. $4.50.

This basic introduction to theoretical meteorology starts with the fundamental principles of physics and carries through to a consideration of the tools of thermodynamics and hydrodynamics needed for the understanding of atmospheric motion.

WINGS AND THE WEATHER, by A. L. Chapman, Raymond Fletcher, and C. C. Maxey. Pitman Pub. Corp., New York City. 188 pages, drawings, charts, glossary. $1.75.

A handy study guide in meteorology for pilots, this book includes questions and answers for review purposes.

INDUSTRIAL PLASTICS, by Herbert R. Simonds. Pitman Pub. Corp., New York City. 396 pages, photos, index. $5.00.

This third edition brings the list of American plastics up to date, with new developments and processes described. Chapters on foreign practice are expanded to cover all countries using plastics, with special emphasis being given to South America. Sections on the chemistry of plastics, also tables, statistics, and charts, are revised in the light of latest research.

PER ARDUA, The Rise of British Air Power, 1911-1939, by Hilary St. George Saunders. Oxford University Press, New York City. 356 pages, photos, maps, index. $3.75.

An authoritative history of British air power from its beginnings to the opening year of the war, by a writer who has contributed many other books on various branches of British military services. This present volume will be valued as a reference work.

EMPLOYMENT TESTS IN INDUSTRY AND BUSINESS, 1945. Industrial Relations Section, Princeton University, Princeton, N. J. 46 pages, index. $.50.

Selected and annotated bibliography of books, pamphlets, and articles treating pertinent test procedures in employment field.

AUTUMN LEAVES. Reflections of an Industrial Lieutenant, by P. W. Litchfield. Corday & Gross Co., Cleveland, Ohio. 125 pages. Introduction by Dr. Jerome C. Hunsaker of MIT, illustrated by Rockwell Kent.

Written by the chairman of the Goodyear Tire & Rubber Co., this book is a distillation of his personal and business philosophy developed through an experience of 45 yr. in industry. "The world of tomor-

(*Turn to page 266*)

Champion - *on Every Count*

The next challenge in air transportation is to get more revenue dollars from equipment. And like the champion it is, the Cyclone 9 is ready to match its power and economy against the field.

To operators who must stay in the black to stay in business, the Cyclone 9 offers two things. First, the power and mechanical performance necessary for airline operation. Second, economy—in the form of more power per pound, more value per maintenance dollar and more miles per gallon of fuel. These qualities come from the 18 years of flight and research and refinement which have made the Cyclone 9 the most highly developed aircraft engine in the world. Only by combining this power performance with economy could the Cyclone 9 have become a major airline engine and the greatest source of power for four-engined bombers.

Now, with a sharp increase in power, and with added refinements for greater economy and improved operation, the Cyclone 9 is available for the new types of planes which will bring about true mass transportation by air.

Backbone of Business

Air transportation of tomorrow will demand many types of planes: feeder, trunk and transoceanic. Yet the backbone of the business will be the transport carrying goods and passengers short distances quickly and economically. In this field, the Cyclone 9 is unexcelled as a source of power.

WRIGHT
AIRCRAFT ENGINES

DIVISION OF
CURTISS WRIGHT
FIRST IN FLIGHT

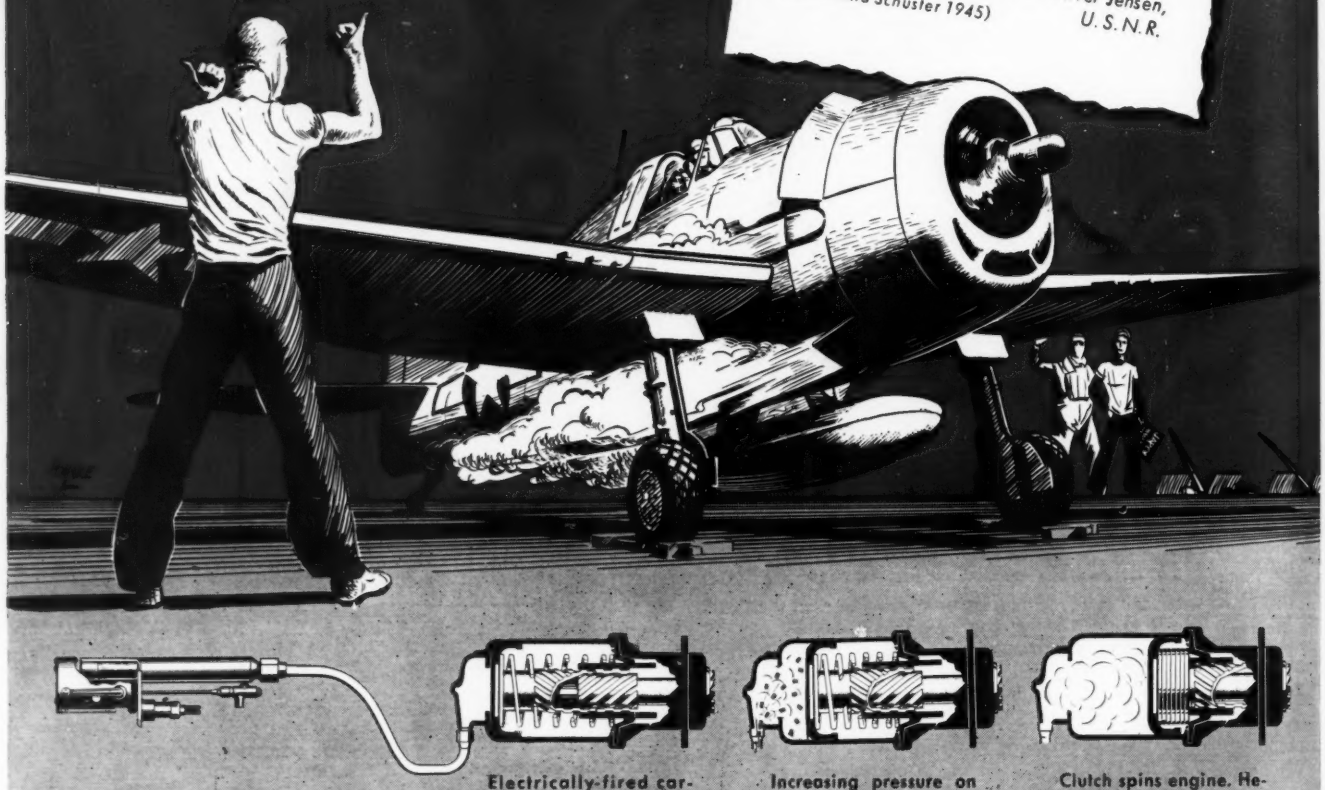
Wright Aeronautical Corporation • Paterson, New Jersey, U. S. A.

Carrier War

and the Breeze Cartridge Engine Starter

"To start the engine of an F6F fighter, you don't press the button of an automobile-type self-starter (that would be too heavy), and you don't spin the prop by hand a la World War I (no man would be strong enough to turn it). Instead you insert a little explosive charge which looks like a shot gun cartridge in a firing mechanism under the engine, then close a little door. The pilot in his cockpit simply presses an electric button, the cartridge fires like a pistol, and the resulting gust turns over the engine".

—from **CARRIER WAR**, by Lt. Oliver Jensen, U. S. N. R.
(Simon and Schuster 1945)



Electrically-fired cartridge drives slow-burning pellets into chamber.

Increasing pressure on piston turns clutch jaw through helical splines.

Clutch spins engine. Helical spring returns piston to starting position.

Manufactured under Coffman patents

● The Breeze Cartridge Engine Starter is familiar equipment on the hard-hitting carrier squadrons of the U. S. Navy. Providing a quick, dependable means of starting the most powerful aircraft engines, this starter has built up an enviable service record in all theatres of warfare. Operating on the spiral drive principle, as illustrated above, the light-weight Cartridge Starter smoothly transforms the 30-ton thrust of the fuel charge into crankshaft torque. The various models of the Cartridge Starter now in service are designed to spin into instant life engines ranging from 300 to more than 3000 horsepower.

BREEZE

Corporations Inc.

NEWARK 7 BREEZE NEW JERSEY

THE AVIATION NEWS

BLAINE STUBBLEFIELD, Washington HERB POWELL, New York

CAB Authorizes PAA, TWA, and AA-AEA To Operate Over Atlantic and On to Far East

. . . National airport program now taking solid form . . . Parts sales now organized; 125 craft get civil okay . . . 18,000 civil craft in use; flight areas up

After a long delay, and while the "chosen instrument" vs. controlled competition issue was still being fought out in Congress, CAB has authorized operation of three trans-Atlantic routes by Pan American, Transcontinental & Western Air, and American Airlines-American Export Airlines. The Atlantic U.S.-Europe flights carry heaviest of air traffic.

Along with this announcement had come the Board's approval of purchase of AEA by AA for $3,000,000, which in effect makes American Airlines one of the two new carriers over the Atlantic. Dissolution of AEA is not being considered; the airline is to continue as a separate corportion under its present name. Combine will be called American Airlines System.

Though PAA lost its battles for the "chosen instrument", it still retains all its present routes, which are in the best traffic zones, and it gains new routes abroad, plus entry into the U.S. The CAB has authorized PAA to operate to Boston, Chicago, Detroit, Philadelphia, and Washington, in addition to New York City.

The trans-Atlantic decision (see accompanying map) enlarges this airline's present route to London, now carrying on through Europe and the Near East to Calcutta, by way of Brussels, Prague, Vienna, Budapest, Belgrade, Bucharest, Istanbul, Ankara, Beyrouth, Bagdad, Teheran, and Karachi. Barcelona has also been added to company's present Lisbon-Marseilles route.

AEA is now certificated to operate from New York City, Boston, Philadelphia, Washington, Detroit, and Chicago, via Labrador, Greenland, and Iceland, to Glasgow and London, and from Iceland to Stavanger, Stockholm, Helsinki, Leningrad, and Moscow; also via Newfoundland to Foynes, London, Amsterdam, Copenhagen, Berlin, Warsaw, and Moscow.

TWA was granted a route from points in the U.S. (airline has stated its intention of using Boston as a co-terminal), over a northern route to Foynes, Paris, Berne, Rome, Athens, Cairo and Jerusalem. Basra, Dhahran, and Bombay, plus a southern leg to Lisbon, Madrid, Algiers, Tunis, Tripoli, Benghasi, and Cairo. Moreover, it can also operate by way of Lisbon and Madrid to Rome, where the company will connect with its services over its northern route.

With conditions as unsettled as they now are in the war-torn and Allied-occupied countries in Europe, it is apparent that there are many problems and details yet to be worked out before the airlines can actually start operating complete services over the routes. But now having hurdled the initial barrier by getting CAB certification, the airlines and the U.S. can begin to iron out the attendant difficulties.

The McCarran bill providing for a foreign service corporation was defeated in committee and is now regarded as dead, while the proposal to exclude domestic airlines from flying abroad was getting nowhere, as we went to press.

When leaders of the Senate Commerce Committee (which had jurisdiction over the McCarran bill and related bills) were convinced the fight was ended, they advised the President, who had held up action by CAB pending Congressional determination of foreign air policy. Mr. Truman then approved the Board's authorizations.

Regarding extension of Pacific routes, CAB has recommended that United Airlines be authorized to establish a

Coming Up

(Meetings and dates subject to wartime conditions under ODT Regulations)

Aug. 16 - 17: IAS Los Angeles Meeting.

Sept. 2: Interhemisphere Conference on Frequency Allocations and Revisions, Rio de Janeiro. (Postponed from June 2.)

Oct. 4 - 5: IAS Light Aircraft Meeting, Detroit.

Oct. 4 and Nov. 1: SAE Southern California Section Aeronautic Meeting, Hotel Biltmore, Los Angeles.

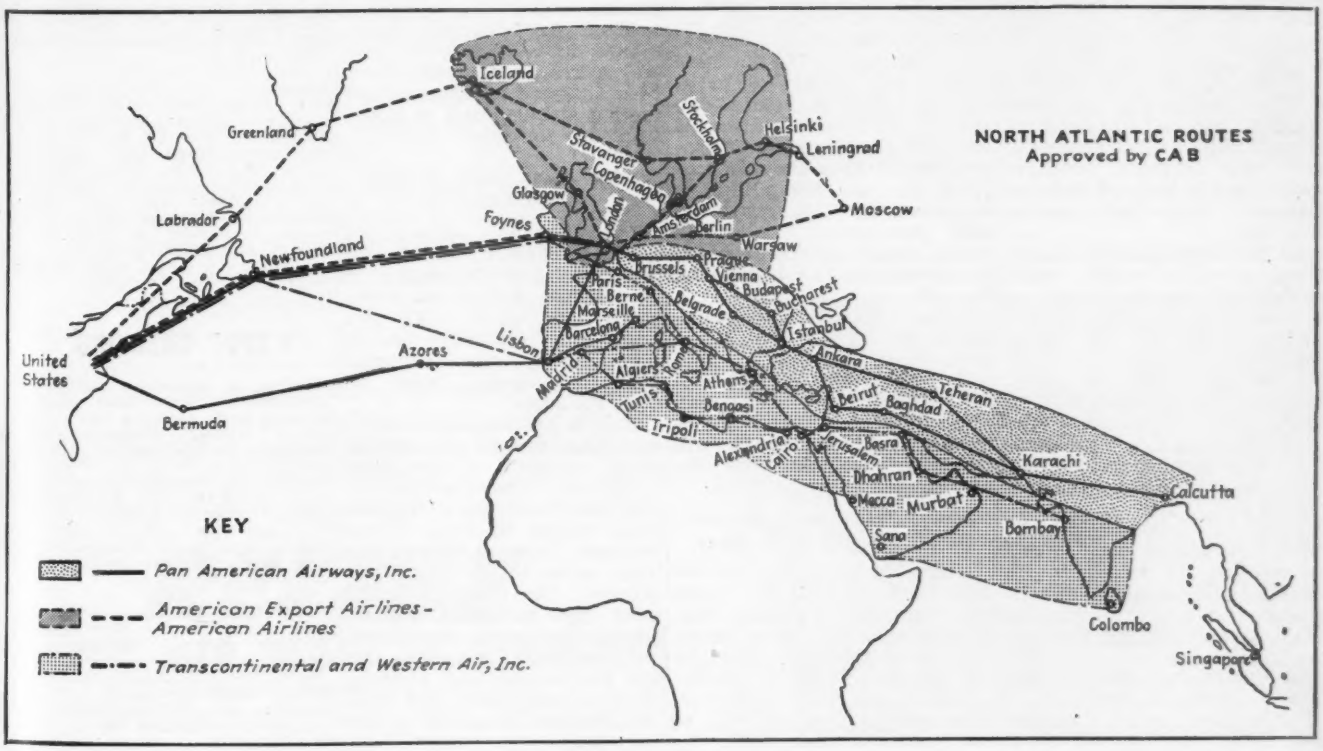
Oct. 16: First Annual Meeting, International Air Transport Assn., Montreal.

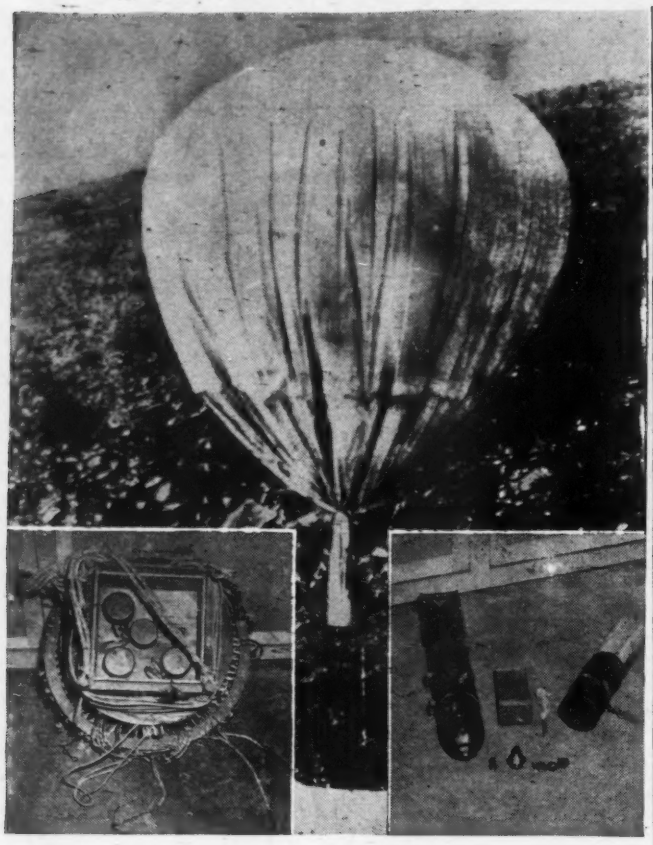
Oct. 26: IAS Washington Meeting.

Oct. 31 - Nov. 3: 1945 National Aviation Clinic, Oklahoma City. (Pre-clinic conferences start Oct. 27.)

Nov. 16: IAS Engine & Accessories Meeting, Dayton.

Dec. 17: IAS Wright Brothers Lecture, Washington, D. C.





BAG NIP "V" BAG

First photo of paper-made war balloon of type Japs have aimed at America in an attempt to score hits on our homeland. Carrying fire and anti-personnel bombs, bags are designed to destroy themselves after all explosives have been dropped. Insert left is a closeup view of aneroid barometers which actuate release of bombs, while right insert shows an incendiary bomb (right) and a 33-lb. anti-personnel missile carried by balloon depicted. Bag was found in western Canada. (Press Assn. photos)

route linking San Francisco and Los Angeles with Honolulu. PAA has not flown to Hawaii commercially since Pearl Harbor.

National Airport Program Now Taking Solid Form

After controversy over the years, a national airport program is beginning to shape up, and this program probably will take the form of finished legislation in the latter part of this year.

Of the many airport bills in Congress—all of which would authorize appropriation of federal funds to be matched with state, county, or municipal funds, for the construction of about 3,000 new fields, bringing the country's total to about 6,000—the latest is HR-3315, introduced by Rep. Clarence Lea of California.

Mr. Lea previously had included the airport program in his omnibus bill to revise the Civil Aeronautics Act. When he saw that he could not get agreement on that bill, he separated the airport provisions from it, and offered the airport measure as HR-3170. Then the House Interstate and Foreign Commerce Committee, of which Mr. Lea is chairman, revamped the measure and Lea introduced the new version HR-3615.

Under the revision, there is no change in the formula for allocating monies, and Federal funds can be used to purchase lands. Any public agency—city, county, or state—can qualify for federal aid for its airports. A planning appropriation of $3 million is provided for, and $50 million is suggested for U.S. territories and possessions. Allocated funds cannot be re-allocated to another sponsor until June 30, 1956.

On the Senate side, a subcommittee of the Commerce Committee approved a bill which would provide $500,000,000 annually, 65% for small airports, and 35% for big-city projects. This division will be further contested by city and state politicians.

Parts Sales Now Organized; 125 Craft Get Civil Okay

Plans for the sale of $1 billion worth of airplane parts and components through regular commercial trade channels have been completed by the Surplus Property Board.

Cost of the warehousing and sales program, which will be handled by the Reconstruction Finance Corp., will be about $45 million. It is hoped that substantially all of the government's stock of parts and components can be sold within a year, since prices will decline rapidly after that.

At this writing there was no indication that SPB intends to sell government surplus airplanes through trade channels. Continuous criticism by service operators, leveled at direct sales from government to purchaser, recently culminated in an appeal by National Aviation Trades Assn. to the Senate Small Business Committee, headed by Sen. James E. Murray. Asked was a Congressional investigation.

Roscoe Turner, NATA president, requested permission to submit further evidence, and he suggested that Congress determine whether plane purchasers are satisfied, and if not why. The service operators want to distribute the surplus planes themselves. Turner quoted the Surplus Property Act at length to establish his case.

Civil Aeronautics Administration has approved of 125 types of surplus military aircraft for civilian use—mostly liaison, trainers, transports. They are the products of 21 different manufacturers.

Over 130 models have been found by CAA to be unsuitable for civilian certification. These are mostly tactical types, such as bombers, fighters, special trainers, all built especially for military use. RFC has about 6,000 of these tactical planes in surplus. There is strong pressure on Congress to rule that most of them be junked. Some are being allocated to schools for experimental purposes.

About 3,000 surplus lightplanes have been sold; several scores of transports have been allocated to domestic and foreign airlines; and 88 Lodestars are for sale.

18,000 Civil Craft in Use; Flight Areas Up

There are now some 18,000 training, charter, rental, and private aircraft operating in the United States, as compared with about 8,000 two years ago, according to an estimate by the National Aeronautic Assn., based on CAA statistics.

This is phenomenal growth, says NAA, in face of restricted flight, cessation of new plane production, and gasoline rationing. Even more remarkable, chimes in CAA, is the increase from 1,800 civilian flight areas to over 3,000 this summer. The prewar airplane peak (not including military and air transport) was 25,000.

Planes have been going into use for purposes of training, charter operations, and business flights. Hundreds of new students are reported in many localities. The shortage of airline seats has caused many lighter craft to be put into charter, contract, and taxi service. About 3,000 airplanes have been transferred from surplus military to civilian status.

★ KNOW-HOWS ★

Conveyor cleaning system, devised by Rome ATSC, uses overhead chain belt in series of turns, thus enabling installation of 400-ft. line of tanks in space only 46 by 86 ft.

Graphite-base thread lubricant for sparkplugs, developed by General Petroleum, is stated to have eliminated galled threads and seized plugs in B-24 engines.

Helium gas in tires is disclosed by Convair to have effected weight saving of 154 lb. over air on Model 37 airliner landing gear.

Magnetic thickness gage, used by GE for measuring thickness of plastic cabin windows, permits detection of inaccuracies of less than 0.08 in.

Neon bulbs, states Goodrich, have been found effective in testing rubber belts and hose for static conductivity, with object of eliminating fire risk caused by static sparking.

Lucite bands are reported by duPont to be used by ATSC as safeguards against risk of shock absorber cylinder collapse when deflating aircraft landing gears.

Black light as means of detecting minute holes in welds is said by Surface Combustion Co. to have reduced rejects from 35 to 1%.

Alemite centralized lubrication of landing gears, flaps, and cowl rings is claimed by manufacturer to have saved over 4 hr. at each lubrication period.

Combustion analyses are cited by Richfield to have enabled production of J-P fuels giving greatly increased power and efficiency, with new fuels being keyed for requirements of specific engines.

Record of 8,064 dressings for only 10.55 carat loss between sixth and seventh setting is reported by Diamond Tool Co. for special diamond tool used on 24-in. dia., 3-in. face, Norton crankshaft grinder (401N27 Carborundum wheel). Called largest of industrial diamonds, stone originally weighed 62.5 carats, and after 4½ yr. of constant service it is still in use with 19.2-carat weight.

★ SPOT CHECKING ★

Aiming to promote utility of airplanes on farm and adaptation of craft to farm life, Oklahoma Flying Farmers were readying a display of personal planes on campus of Oklahoma Agricultural & Mechanical College, Stillwater, as we went to press. During display, Flying Farmers planned to hold a forum and panel discussion on how they use light craft in their farming operations.

Formation of a Brazilian company to undertake development of air pickup operations in South America has been completed by All American Aviation. New company will be known as Equipamento All American Aviation S/A. It is

REVERE light metals widely used in Fairchild "Packet"

Fairchild C-82 "Packet" has a range of 4000 miles with 2312 cubic feet of cargo space—88% of the capacity of a railroad boxcar.

THE great interest created by the Fairchild C-82 "Packet" arises only partly from its obvious usefulness in the war. Many see this remarkable airplane as a "preview" of peacetime things to come. Now an Army cargo and troop carrier, it may well be the herald of future traffic in air freight.

The C-82 has sometimes been called the "flying boxcar". It might also be called a "flying inventory of Revere aluminum tubing", for in it is used a broad cross-section of the types and sizes of aluminum alloy tubing produced by Revere. In addition, Revere magnesium alloy sheet and plate are used for a number of purposes. Among them is the large instrument panel illustrated here.

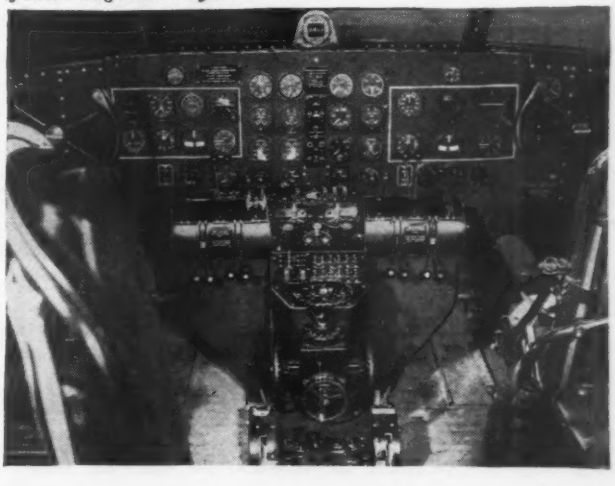
The use of Revere magnesium in this new airplane is testimony to the way engineers have come to regard the wrought magnesium alloys in their untiring search for new and better ways to reduce unproductive weight. In the high strength-weight ratio of magnesium alloys, in the opportunity these materials offer for increasing the local stability and stiffness of many structures without weight penalty, and in the substantial weight savings often directly possible, engineers find an attractive avenue for advances in aircraft performance.

For detailed information on magnesium alloy sheet, plate, tube, rod, bar, extruded shapes and forgings, call Revere. A Revere Technical Advisor will gladly consult with you.

Here is the way a 2½-ton Army truck can climb into the "Packet" under its own power. The ramp is carried inside the airplane.

• • •

View of the instrument panel, one of the various units in the "Packet" made of Revere magnesium alloy sheet.



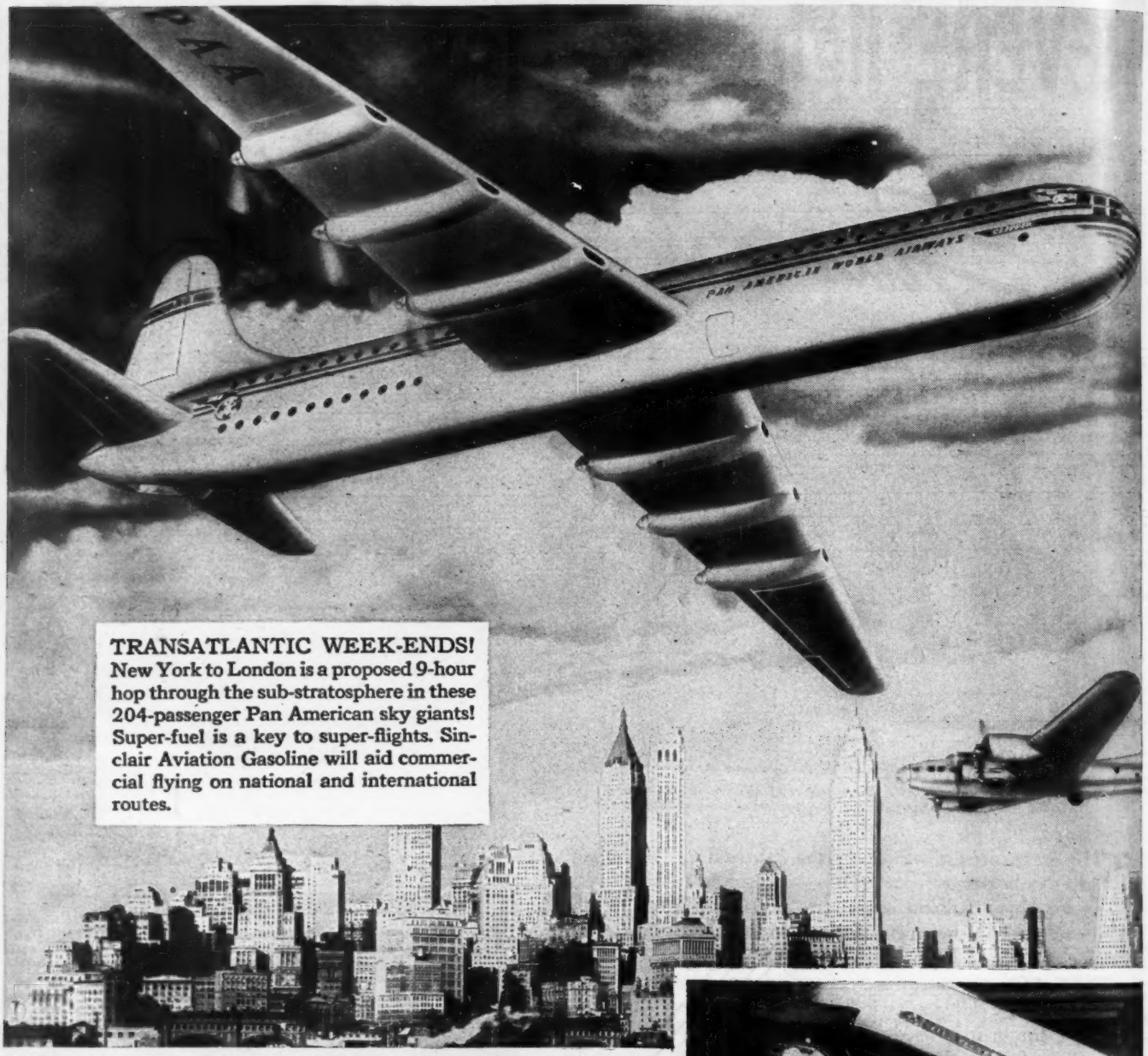
REVERE

COPPER AND BRASS INCORPORATED

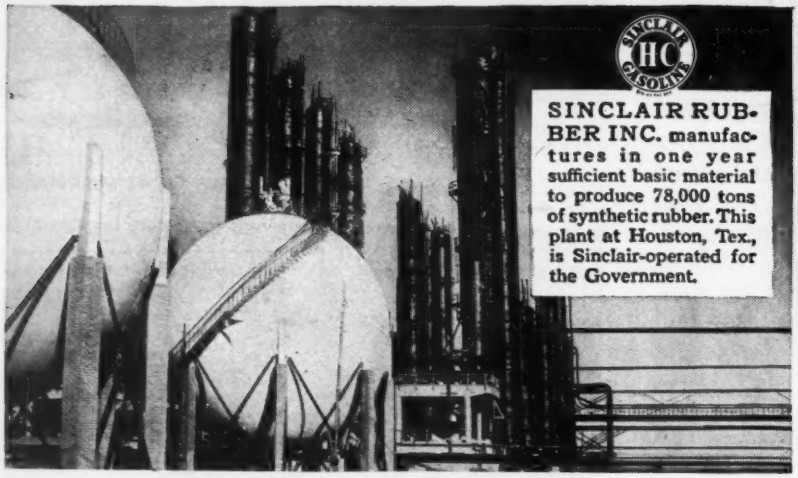
Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N. Y.

Listen to The Human Adventure
on the Mutual Network every Wednesday evening, 10 to 10:30 p. m., EWT



TRANSATLANTIC WEEK-ENDS! New York to London is a proposed 9-hour hop through the sub-stratosphere in these 204-passenger Pan American sky giants! Super-fuel is a key to super-flights. Sinclair Aviation Gasoline will aid commercial flying on national and international routes.



SINCLAIR HC GASOLINE

SINCLAIR RUBBER INC. manufactures in one year sufficient basic material to produce 78,000 tons of synthetic rubber. This plant at Houston, Tex., is Sinclair-operated for the Government.

DIRTY or defective spark plugs can waste one gallon of gasoline in 10 . . . can contribute to excessive wear that junks cars. Save gas, save wear, save your car! See your Sinclair Dealer regularly.

SINCLAIR AVIATION OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

stated that operations are expected to begin this month. Similar companies are also planned in other South American countries. Specifications have been submitted to numerous American companies for specially-designed gliders, which are to be used in addition to pickup and conventional cargo craft.

Wisconsin has passed what is termed the first state law authorizing high school contracts for flight instruction of pupils. State's Department of Public Instruction, with help of CAA, worked out a program calling for 4 hr. of flight experience in addition to classroom aviation studies.

TP-51 is revealed as designation for NAA's two-place Mustang adapted to dual instruction (pictured in Feb. AVIATION). New craft will be put into limited production for transition, gunnery, and tactical training.

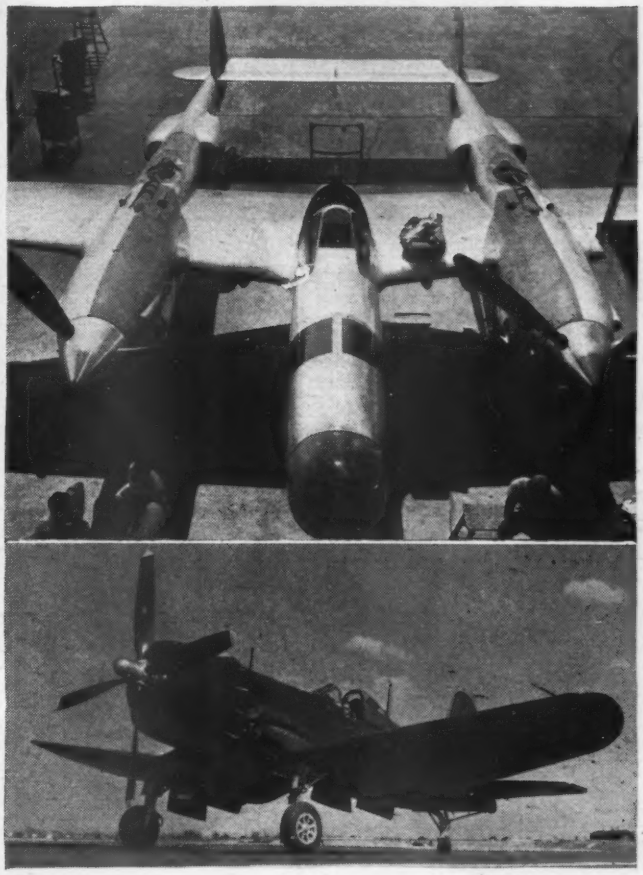
Delegation of aviation, education, and public relations authorities attended first Congress on Air Age Education to study "How the Airplane Can Serve Mankind Tomorrow," at University of Denver. Exploring airplane's possibilities in four major categories — geography, socio - economic institutions, aero-politics, and cultural relations — Congress was seeking best method of educating youth and adults re civilizing effects of aircraft.

Four new types of giant Clippers were revealed to be planned for operation by PAA. Clipper Type 8 will be Lockheed Constellation, to carry 56 passengers at 300 mph., with over 1,500-mi. range, for express schedules on medium-range routes. Type 9 is to be Douglas DC-7, to carry 108 passengers at 300 mph., with a range in excess of 2,500 mi. Type 10 will be Lockheed's four-engine L-89, to carry 128 passengers and crew of eleven at 300 mph. for a 2,300-mi. range. Latter craft is to have two decks, nine luxurious staterooms (each with two berths), twelve additional berths, 89 reclining chairs, several rest rooms, and cook's galley. Type 11 will be Convair's CV-37, to carry 204 passengers at 340 mph., with a 3,100-mi. range.

Add Forecasts: U. S. will have a minimum of 3,500,000 licensed personal pilots by 1960 if progress made since 1929 continues at same rate, William A. Mara of Bendix predicted. He also declared that at end of war there will be a pool of some 6,000,000 active or potential flyers in this country. Nucleus of this pool, Mara said, will include: 107,327 personal pilots holding CAA licenses at end of '44; 25,000 licensed transport and commercial pilots; 159,000 pilots listed as trained by AAF as of December 1, 1944; and 47,000 pilots listed on Navy's roster as of Dec. 1, 1944.

BOAC is quoting price of one-way flights from Baltimore to London as $572-plus-tax, for total of $657.80. Departures from Baltimore are on Sundays, Tuesdays, Thursdays, and Fridays, at 11:30 p.m.

Need for elevated landing terminals adjacent to principal post offices in all large metropolitan cities of 250,000-and-up population was subject of recent talk by Oliver Parks. Also revealed was plan for such a terminal in St. Louis, to be located alongside of Municipal Post Office and Union Station. This would have on its roof a north-south flight deck 250 ft. wide and 2,600 ft. long, plus an east-west deck 250 ft. wide and 3,000 ft. long. Beneath decks would be storage space for planes, and elevators would raise and lower craft. On ground would be an airway station, automobile-bus depot, parking space, and sufficient warehousing space to take care of freight delivered by planes, trucks, and trains. Estimated cost of structure would be about $15,000,000.



PATHFINDER LIGHTNING AND SPEEDIER CORSAIR

With special detecting equipment fitted in a blunt, round nose, Lockheed Lightning Pathfinder (top) is able to pinpoint targets—through fog, darkness, or bad weather—for other formations of high-flying P-38 bombers, which carry up to 4,000 lb. of bombs each. A second crew member, seated between nose and pilot, operates highly accurate "Mickey" bombsight and is able to aim and also drop bombs for entire group.

Above: Latest model Vought Corsair to see action is this F4U-4, incorporating new P&W Double Wasp R-2800-C engine of 2,100 hp., four-blade Hydromatic propeller, larger cowl flaps, cleaned-up cockpit canopy, and elliptical-shaped engine cowl, with air intake in bottom. New craft now has over 425-mph. top speed and rate-of-climb has been increased almost 1,000 fpm. (AVIATION staff photo)

Famed prewar Bendix Trophy Race is planned to be resumed in new peace by Bendix Aviation. It is stated that event will stimulate research and development of airplanes and accessories in addition to spotlighting aviation. Best cross-country Bendix time was established by Frank Fuller in 1939, with a time of 7 hr. 14 min. in a specially-prepared Seversky racer. Aircraft development since then was demonstrated by 6 hr. 3 min. 50 sec. cross-country flight by giant Boeing C-97 in January.

Cockpit standardization for single - place, side - by - side, and transport aircraft has been aim of recent discussions by Joint Aircraft Committee of AIAA (formerly Aero Chamber). Full size mockups of such standardized cockpits would be made available to manufacturers on a loan basis, according to plan outlined. Emphasis would be placed on establishment of direction of motions, location of control groups, and desirable shapes and colors of aircraft controls.

Engineers doing original research in welding fields are invited to send their papers to Davis Welding Library, Ohio State University, at Columbus, Ohio, for permanent filing and use by industry. Also sought for patent references are numbers of patents pertaining to welding and welding equipment, machine design, structural design, and applications.

Ercoupes are scheduled to be merchandised this Fall through Marshall Field & Co., Chicago department store. Contract for this sales plan was completed through Parks Aircraft Sales & Service, East St. Louis. Parks salesmen are to handle the selling of the Engineering & Research Corp. craft, with demonstration flights to be made from a Chicago airpark.

Publications: Booklet "Army-Navy Contractors Guide for Prime and Subcontractors" may now be obtained without charge from Readjustment Distribution Center, 6th Floor, 90 Church St., N. Y. C. (7). This 60-page illustrated work offers an outline for contractors which suggests methods of advance planning and depicts practical procedures for the settlement of terminated contracts . . . "An Estimate of the Postwar Air Freight Potential From Detroit to San Francisco" is title of special survey report issued by Edward S. Evans Transportation Research, 435 Woodward Bldg., Washington, D. C. Also available are these further reports: "Postwar Air Transportation of Fresh Strawberries and Tomatoes From Florida to Detroit," "Postwar Air Transport Costs and Markets for Lettuce," "The Use of Surplus War Cargo Planes to Transport Agricultural Perishables," and "The Place of the Contract Cargo Airline in America's Postwar Sky." . . . Now being distributed is "1945 SAE Handbook," giving new standards on electrical equipment and non-metallic materials, and also the revised standards on gasoline engines, iron and steel, lighting, non-ferrous metals, and parts and fittings. Limited supply of this 620-page work is offered to non-members at $5 per copy through SAE office at 29 W. 39th St., N. Y. C. (18). . . . Now underway is compilation of National Research Council's directory, "Industrial Research Laboratories in the United States." This 8th edition will be first revision in 5 yr. Research men are asked to check with their directors regarding reception of questionnaire for laboratory coverage in directory. If not yet received, questionnaire will be sent upon request to Library of National Research Council, 2101 Constitution Ave., Washington (25), D. C.

AMERICA AT WAR

Aviation's Communique No. 43

Maj. Gen. Curtis E. LeMay, commander of the 21st (Marianas) Bomber Command, recently stated at a press conference in Washington, that American air power can and will knock industrial Japan out of the war. LeMay is the first high authority in aviation to make such a definite prediction. He said that, because the B-29's carry heavier loads, Japan is already getting a rougher beating than Germany got from a thousand B-17's and 24's. Superfortresses attacks, he promised, very soon will be on the thousand-plane scale. In addition, of course, the enemy will be pounded by the Navy's aviation and by the Army's Eighth and other sky forces.

Superfortresses and other aviation started, July 1, to drop destruction on the enemy at the rate of 2,000,000 tons per year, according to General H. H. Arnold, chief of the Air Forces. That may be compared with the rate last May of 288,000 tons per year. The two million ton rate will "scale" at 5,480 tons per day. Of the two million tons, 1.3 million will come from the Marianas and Okinawa, and .3 million from Gen. George C. Kenney's air forces under Gen. MacArthur. Gen. Arnold said he did not mean to imply that the Japs can take this sort of punishment "by the year," but our forces are ready for them if they can.

Marking AAF Day (Aug. 1) a force of 882 B-29's hit Japan.

Planners of the future plan with "U.S." KOYLON FOAM

PLANES: Koylon lightness fits plans for tomorrow's plane interiors.

HOTELS: Koylon comfort meets schemes for room, lobby and restaurant furnishings in tomorrow's hotels.

TRAINS: Koylon all-condition restfulness is ideal for the cars of tomorrow's streamliners.

BUSSES: Koylon clean, cross-country comfort is perfect for tomorrow's busses.

TRUCKS: Koylon durability is particularly valuable to tomorrow's trucks.

Dohner & Lippincott

INTERIORS: Koylon adaptability is especially suited for upholsterers and designers of tomorrow's interiors.

You can plan with Koylon, too

If you're tomorrow-minded—you're bound to be Koylon-minded. Because, after the war, "U. S." Koylon Foam will return—*Comfort Engineered* to meet your particular requirements.

For ten years, Koylon has proved the ultimate in comfort. To sit or lie on Koylon means to be caressed in bottomless comfort that only a combination of pure air and buoyant rubber latex can give.

Koylon comfort is equalled by its vermin-free, perspiration-free cleanliness. Koylon durability makes it amazingly economical. Not only does Koylon keep its shape permanently, but its even support gives longer life to the upholstery around it. Repairs, renovations, replacements become rarities, because Koylon has no troublesome supporting parts.

Comfort Engineered "U. S." Koylon Foam merits a place in your future plans.

Comfort Engineered

"U.S." Koylon FOAM

reg. u.s. pat. off.

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

Serving Through Science

UNITED STATES RUBBER COMPANY

★ TAGGING THE BASES ★

Round Lake, N. Y. Seaplane base is now reconditioning an ex-AAF Waco equipped with Edo floats. Operator Lewis F. Lavery states his lakeside building, comprising shop, office, restaurant, and rest rooms, is being completely refitted.

Newly opened is Albany, Ga., municipal airport, which Bob Wier is managing.

Basing at Miami, Fla., Pilot W. D. Hilsabeck, uses his seaplane as timesaver when census taking among Keys.

Falls Flying Service, Thief River Falls, Minn., announces addition of a Taylorcraft to fleet.

Dervind Flying School, Matamoras, Pa., is now using Ranger-engined Fairchild M62A for advanced training.

Tacoma, Wash., Flying Service is projecting an 80-acre airpark on waterfront 3 mi. from city center, reports Operator Ben Barry.

Operators within flight distance of Kansas State College, Manhattan, Kan., are specially invited to attend three-day airport development conference slated for Fall. Dean R. A. Seaton, of Engineering, may be checked for arrangements.

Bob Johnson, Missoula Airport, Mont., is active in promotion of state Aviation Trades Assn., assisted by Carl Schirmar, Spokane, members of Washington organization.

Eldon, Mo., plans to open new municipal airpark with special "service station on wheels" carrying all necessary equipment for line service, states Mayor Bob Reed, mainspring of project.

Trained by 17 operators, 371 Tennessee students from 45 high schools have received 4-hr. flights at expense of State.

•

A country-club type airport is being built about 5 mi. from city center of Portland, Me., by H. F. Troxel.

★ CANADIAN NOTES ★

By James Montagnes

Defending government against charges that it was destroying many aircraft and much equipment instead of placing it for sale, Minister C. D. Howe said: "A defective plane is a potential killer. The government would certainly be held blameworthy if any of these potential killers fell into the hands of inexperienced pilots or were used for transport purposes. In order to be sure that carcasses of these planes were not made into usable aircraft, the wooden carcasses were burned and the metal carcasses rendered into scrap and sold as such. War Assets Corp.," he continued, "has several thousand airplanes for sale, and already has sold 400. Every plane sold is put in first-class condition before it leaves the custody of the government. Anyone needing an airplane of the types used in air training need not go to the junk pile for it."

THE WASHINGTON WINDSOCK

By BLAINE STUBBLEFIELD

Our Postwar Plan: Round up all the fastest airplanes in the world and make them run a 500-mi. race, each choosing his own altitude, no excuses accepted from losers. After that there will be only *one* fastest airplane—for a while.

Military domination of this civilian government is wearing thin. Congress soon will call for accounting on production of supplies and weapons that will never be used. The responsible officers' fear of being caught short of supplies, soon will swing, like a radio compass passing a station, to fear of being caught long on extravagance.

People who said that armies would fly with all their duffle were right. One whole Chinese army has been flown. Of course, airborne services have only got a bare start in this war; however, if there is more war, this sort of thing will be fully exploited. It's envisioned that rocket transportation of explosives and freight (if not soldiers) will add up to future attacks which will make the old blitzkrieg look like a sack race.

One World, as Willkie called it, will be more evident in aviation (with electronic communications, traffic control, and avigation) than in any other field. The long range signal will overlap around the world; limited frequencies will make community use mandatory. Formation of a world aeronautical radio organization will be an important—and difficult—task.

Congress is pleased, in general, with policy and action of the CAB, and there will be strong opposition on the Hill and in the White House to all proposals to throw aviation into a transportation agency with other interstate commerce—also against measures to set up a new aeronautics commission independent of the Commerce Department.

ANOTHER BIG "B" IN NIPPON'S BONNET—THE 32

Here is Convair's B-32 heavy bomber, now revealed by AAF to be in action against Japs. Craft is a high wing, and a dominant feature is lofty rudder, which towers 32 ft. 2 in. Nose profile is "stepped" by contour of control cabin, and position for bombardier angles plane's chin. Power is supplied by four 2,200-hp. Wright Cyclone engines fitted with Curtiss electric props, and dual-wheeled tricycle landing gear is employed. Span is 135 ft., length 83 ft. 1 in., and gross weight is in 60-ton category. In size comparison, Boeing B-29's span (141 ft. 3 in.) and length (99 ft.) are slightly greater, while tail height of Superfort (27 ft. 9 in.) is less. (A detailed story on B-32 will appear in September Aviation.)

Boeing of Canada's Vancouver plant may possibly make postwar commercial aircraft for Russia, according to industry rumors. Such a project would have to await finish of current job on Superfort bomb bays and other sections.

A National Air League of Canada was recently formed at Montreal, with Air Industries & Transport Assn., Air Cadet League of Canada, Canadian Flying Clubs Assn., Air Force Veterans Assn., and Soaring Assn. of Canada participating.

★ OBITUARY ★

Col. Clifford B. Harmon, pioneer in aeronautics and donor of Harmon Trophy. As early as 1910, after establishing altitude record of almost 16,000 ft. for balloons, he became interested in heavier-than-air craft. First amateur to receive Aero Club of America pilot's license, he established numerous flight records. During World War I he served in Aviation Section of Signal Corps, and later he proposed to League of Nations Council the formation of an international air force. He was founder and first president of Ligue Internationale des Aviateurs.

Henry J. Brown, veteran pilot and attorney. A training pilot during World War I, he later became one of original airmail pilots. Subsequently he was associated with National Air Transport and Ludington Airlines. During National Air Races in 1929, he won 2,100-mi non-stop Los Angeles-to-Cleveland Derby. From 1936 to '41 he served as attorney in Bureau of Aeronautics and CAA, and from '41 to '43 was with PAA, ferrying bombers to Far East. A pioneer in use of blind flying equipment, he also helped in development of stabilizer. He was member of Caterpillar Club, and was president of Cleveland Quiet Birdmen.

Edson F. Gallaudet, aeronautical engineer and inventor. He learned to fly as early as 1911, and in World War I formed Gallaudet Aircraft Corp. He was member of Federation Aeronautique Internationale and associate fellow of IAS.

W. L. Richardson, pioneer in aerial photography. Hailed for his aerial pictures during service as a seaman in U. S. Navy, he was designated official photographer at Pensacola Naval Air Station. He later became ensign, returned to civilian status in 1922, and became Senior Scientist, Bureau of Aeronautics.

★ CALLING NAMES ★

Kenneth MacGrath has been elected pres. of Air Associates.

Harry A. Harter has been named operating general mgr. for East Coast AWPC, Inc. Board also appointed **Ruth J. Stone** as permanent council secy.

Col. William Westlake has been assigned to Air Div. of Allied Group Control Council in Germany.

Miss Katheryn Anderson was appointed to newly created position of Chief Stewardess for Alaska Airlines, inaugurating stewardess service on route.

Maj. Thomas D. Neelands has been elected to Beech board.

Timothy E. Colvin, pres. of Aerco, has been re-named general chairman of Los Angeles Aviation War Conference.

John H. Humpstone has been made asst. director of commercial sales group in charge of export sales for Glenn L. Martin Co.; **Howard Stansbury** became sales mgr. for Mars and other flying boats; and **John E. Soenke,** was named to domestic commercial sales and as mgr. of special projects.

Beverly E. Howard has been named a director of All American Aviation; and **Richard D. Warfel** was appointed company's personnel director.

Arthur G. Renstrom has been made chief librarian for CAA, and **James M. Dikeman** has been named asst. general counsel.

A. C. Martin has been designated mgr. of U. S. Rubber Co.'s airplane tire dept.

Walt Peters has been named pres. of Wyoming State Aero Commission.

W. J. Blanchard, general mgr. for Aeroproducts div. of GM, has been elected pres. of Dayton, Ohio, C. of C.

S. J. Ingram, has been placed in charge of Braniff Airways' Washington, D. C., office.

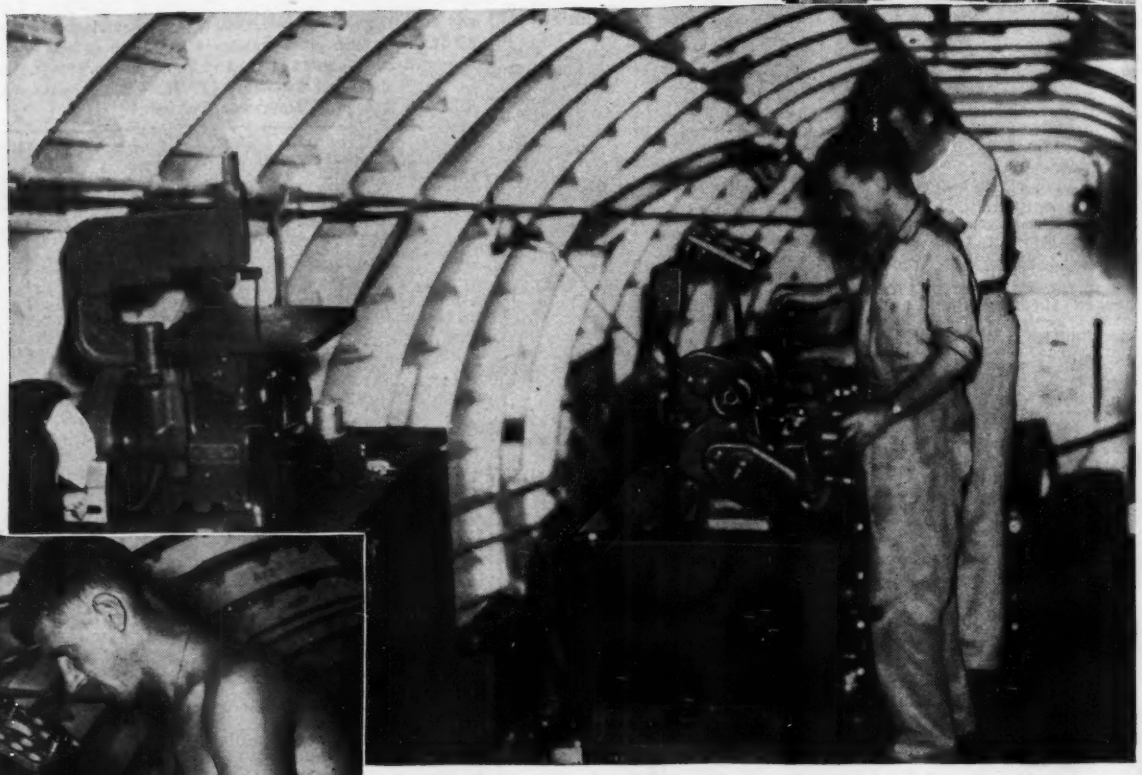
William B. Stout will head auto research and development for Graham-Paige Motors Corp. under an agreement with Convair.

William M. Stevens, N. Y. district traffic mgr. for NAL, has been made sales mgr. for entire airline.

E. A. Rosser has been named TWA's director of sales for airline's central region; and **Leon-**

(Continued on page 211)

FLYING MACHINE SHOPS BACK UP THE B-29'S



Interior views of a Commando Flying Machine Shop of the XX Bomber Command equipped with a South Bend Lathe. Official U. S. Army Photos.

Flying machine shops are playing a vital behind-the-scenes role in the operation of the B-29 "Superfortresses" now carrying on the air offensive against Japan.

With ordinary repair facilities, it takes days or even weeks to repair bombers grounded away from their bases—often they have to be abandoned. Now Curtiss Commandos fly machine shop facilities to these planes, enabling them to quickly return to their bombing missions. These flying machine shops, through the diversity of their metal working equipment, are performing every type of repair work except the complete rebuilding of engines and planes.

The unprecedented job being done by these flying machine shops is bolstering our striking power where it is needed the most. As an important part of this equipment, South Bend Lathes are contributing their dependability, accuracy, and versatility.

Write For
NEW LATHE CATALOG
Shows all South Bend Engine Lathes, Toolroom Lathes, and Precision Turret Lathes in full color. Ask for Catalog 100-D.

SOUTH BEND LATHE WORKS
Lathe Builders for 38 Years
503 EAST MADISON STREET SOUTH BEND 22, INDIANA

Seek Fast Cancellation Process; Industry's Concern Is Tech Setup; Many Craft Lopped

. . . Government now easing off on output controls . . . AIAA faces big job . . . June output: 5,794 planes . . . Next month—Aeroncas . . . "Scrap the tactical!" says SPB . . . ATSC being revamped . . . Tab foreign-carrier needs.

Rapid cancellation of war production contracts, including those for aircraft, is proposed by WPB, which has outlined this speed-up policy in a revision of its contract termination procedure.

The revision is an amendment to Directive 40, which promulgated the Production Readjustment Committee of WPB and which is the executive instrument of the Office of War Mobilization & Reconversion. The Committee reviews procurement cutbacks and the utilization of released production facilities.

The amended section of Directive 40 provides that: (1) Contracts will be canceled as rapidly as possible after V-J day; and (2) that procurement agencies will report to the Production Readjustment Committee those programs which they wish continued after victory.

In general, contracts for combat equipment will be canceled, while those involving the feeding, transportation, and welfare of troops, and those for rehabilitation, will be continued.

Aircraft manufacturers are expressing concern over the prospective sudden stoppage of employment; so far as they can learn, Washington's only plan for tapering aircraft production is that which naturally results from declining military needs.

The industry fears also that technological development contracts will be canceled along with production contracts, because public and congressional interest will decline temporarily at least. There is every indication, however, that Congress is inclined to enact an over-all research measure under which an organization similar to the Office of Scientific Research & Development would be maintained on a permanent basis.

Army Air Forces are interested in general military research because they now use practically all of the weapons and techniques employed by land and sea forces. They regard the maintenance of air power as encompassing far more than primary aero angles.

Gen. H. H. Arnold, Chief of the Air Forces, reveals that in this fiscal year, only 35% of AAF expenditures will be for airplanes, parts, and engines, whereas the amount was 70% in the fiscal year closed July 1. Gen. Arnold said that, since the first of April, 43,792 airplanes have been dropped from procurement schedules.

These reductions are not as large as they seem, however, because average airframe weight is constantly increasing, rising from 4,000 lb. in 1941 to an expected 16,000 lb. next year.

The Air Forces Chief said that most of the planes necessary for carrying on the war to fiscal 1947 have been programmed. He said that a large proportion of the funds available will be allocated to the jet type of aircraft, and he indicated that $66,000,000 may be spent on guided missiles. The Army, he continued, wants to maintain nine government-owned aircraft plants in standby, eight of them being in the midwest.

Government Easing Off On Output Controls

Indications are that the Government is about to withdraw its controls over the production of aircraft, and that it will not take a substantial interest in reconversion of the industry to peace production. Top WPB executives are considering early foldup of the Board's aircraft division.

Producers of light planes already have the go-ahead on peacetime orders, together with "spot" authorization assistance, as and when materials and manpower are available over and above war needs. Transport type planes are being built for the airlines with priority assistance.

It will not be many months till producers of both types will be on their own. And, so far as can be learned, the government has no unusual plans for aiding conversion to peace work.

AIAA Faces Big Job

The time is drawing near when the Aircraft Industries Assn. of America (the renamed Aero Chamber) will resume its function as the representative and spokesmen of a competing group of airplane builders. This will be a man-size job; for a way must be found to serve the airframe, engine, and propeller groups together, or separate in some degree. There will be differences of interest between the producers of light and heavy planes.

Above all, aviation has to be sold to the U. S. public against automotive and rail competition, and a world market for airplanes must be captured.

The man now in line to inherit this job is John E. P. Morgan, newly elected executive director of AIAA.

An engine standards committee, under the Engine Technical Committee of AIAA, has been established at request of the Army and Navy Aeronautical Board.

June Output: 5,794 Planes

Though the June schedule called for production of 6,022 aircraft, the output actually attained was but 5,794, missing the goal by 228 craft. Nevertheless, the month's accent on the heavy bombers was notable, with the planned turnout exceeded by a good 4%. All big-bomber plans met their schedules and two of them went over the top to supply the margin.

Failure to make the over-all schedule was the first miss since February in the current down-moving scale. Prime June drops were in the general bomber and transport classifications.

In the following breakdown of the June output, the first figure tallies acceptances while the second figure quotes the schedule: Bombers 1,915, 2,027; fighters and Navy recon 2,778, 2,853; transports 555, 616; trainers 150, 150; and communication and special purpose 396, 376.

Next Month—Aeroncas

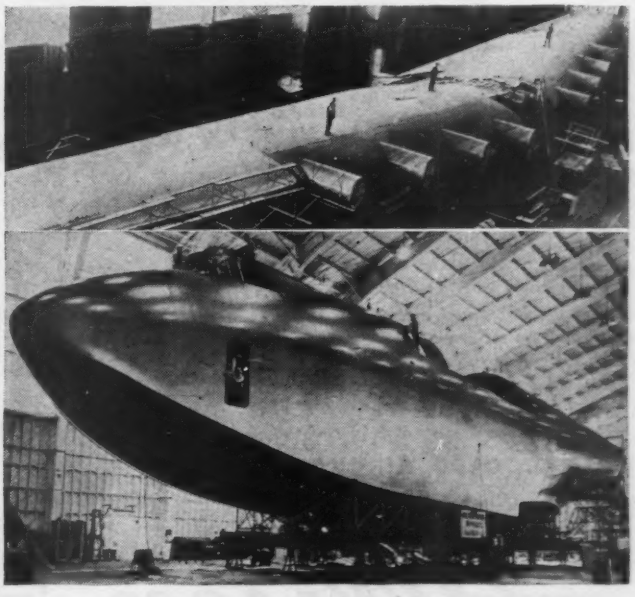
John W. Friedlander, president of Aeronca, has announced that his company will be producing civilian lightplanes before Labor Day. Parts output, he states, is already underway for the craft, without affecting remaining military work.

First to be turned out will be two 2-place models employing a 65-hp. engine and affording a cruising speed of 90 mph.

The company has been negotiating with the Defense Plant Corp. for right to operate the DPC facilities at the Aeronca Middletown, Ohio, plant. Jigs used in military assembly work have been removed, giving space for the lightplane manufacture.

NPA Champions Research

Powerful support for uninterrupted aviation research and military production is given by the National Planning Assn.'s advisory committee on the aircraft industry.

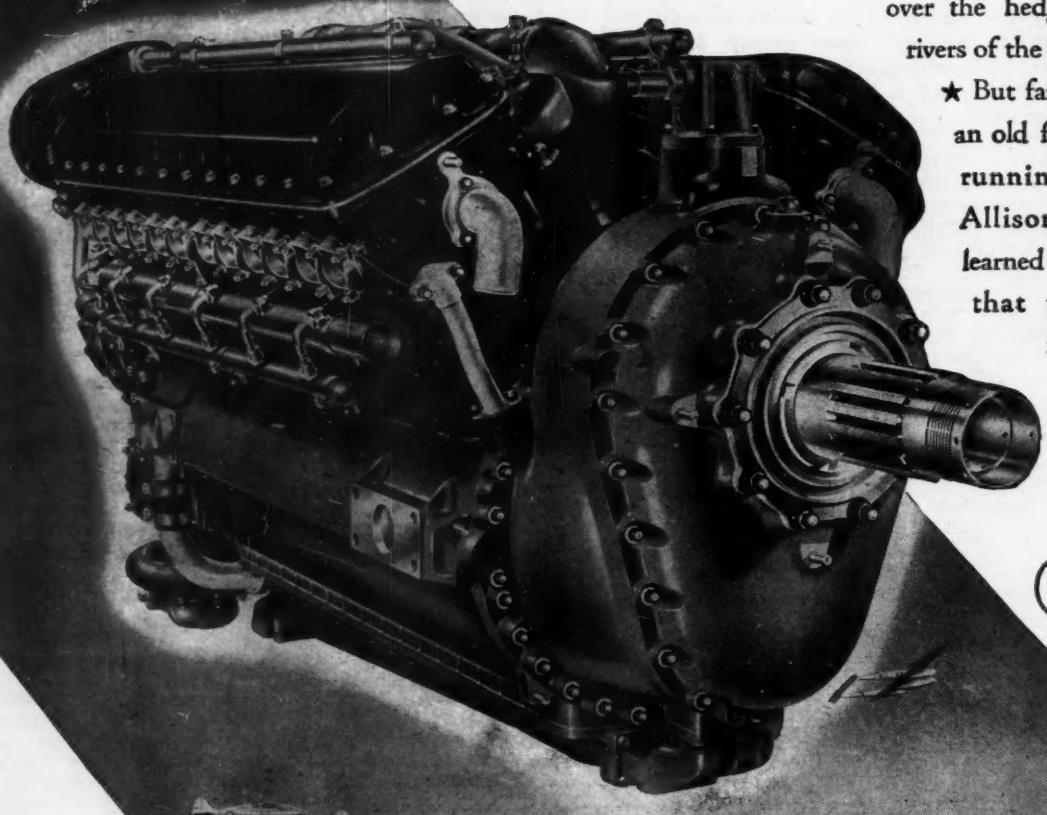


CAN YOU TOP THIS?

Larger than any other flying boat ever built is Hughes Aircraft Co.'s all-wood Hercules, shown here in final stages of construction at Culver City, Calif., plant. Wing has striking span of 320 ft., and huge hull is 220 ft. long, 30 ft. high, and 25 ft. beam. Craft is to be powered by eight P&W Wasp Major engines of over 3,000 hp. each, which would give Hercules an estimated 218-mph. top speed, 175-mph. cruising speed, and a 3,500-mi. range with 65-ton payload. With men standing (on short flights) capacity is put at 750 troops, or 350 hospital patients may be carried. Howard Hughes continued with mammoth project following earlier withdrawal of Henry Kaiser interests. (Press Assn. photos)

REPEAT PERFORMANCE

On plane after plane, "rising suns" line up beside "swastikas" as the men and planes that helped smash the Nazis join the fight against the Japs. ★ Strange are the island-dotted open seas to the pilots who earned their "swastikas" over the hedgerows and winding rivers of the European Continent. ★ But familiar as the voice of an old friend is the smooth-running power of their Allison engines. Pilots learned half a world away that the name Allison means quality workmanship—and a reliable, dependable product.



KEEP AMERICA STRONG
BUY MORE WAR BONDS

POWERED BY ALLISON

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51A—Mustang
P-63—Kingcobra

More than 65,000 Allison engines have been built for the above planes of the U. S. Army Air Forces.

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF GM GENERAL MOTORS

Indianapolis, Indiana

Every Sunday Afternoon—GENERAL MOTORS SYMPHONY OF THE AIR—*NBC Network*

A report by the Association recommends that "The momentum of technological development should not be allowed to collapse while our long-term policies for military aircraft procurement are being established."

NPA is a non-profit non-political organization whose studies and reports carry considerable weight with Congress and executive officials of the government.

"The future of this industry," NPA adds, "especially rests upon the maintenance of an essential nucleus of research, engineering, labor, and management skills." Agriculture, business, labor, and international committees of NPA concurred in the resolution favoring prompt planning to assure the research program.

"Scrap the Tactical!"—SPB

Directing that all tactical airplanes in surplus (unusable by civilians) be scrapped, the Surplus Property Board says that with proper smelting the recovered metal will be good for wrought and cast products at attractive prices.

Scrapping of surplus airplanes probably will produce more than 1,000,000 lb. of aluminum in the next two years. Combat planes are being torn down at the rate of about 100 per week. About 5,000 units are in storage awaiting salvage crews.

No authority has yet determined whether all of the American warplanes will be brought back, but it is estimated that 15,000 or 20,000 will be returned this year. Thus far about 11,000 surplus planes of various types, including flyables for civilians, have been sold for about $20,000,000 as compared with their original cost of $65,000,000.

ATSC Being Revamped

Air Technical Service Command, Wright Field, which is in charge of all Army Air Forces aircraft specifications and procurement, is being reorganized by its new director, Maj. Gen. Hugh J. Knerr.

Maj. Gen. Lester T. Miller is chief of supply, procurement, and readjustment. Maj. Gen. Benjamin Chidlaw heads the engineering and maintenance divisions. It is expected that Gen. Knerr will name a deputy director.

Tab Foreign-Carrier Needs

Foreign Economic Administration in collaboration with the State Department has prepared an estimate of foreign air carrier aircraft requirements. The report lists 49 carriers whose needs are estimated at about 325 planes "to contribute directly or indirectly to the war effort, or to relief, rehabilitation and reconstruction."

This may or may not be a reliable basis for estimating their postwar needs. The foreign lines have requested 339 Douglas DC-3 type units, and only 59 have been delivered. After the war of course some of the foreign lines will buy some of their equipment from the British and from the French. Germany and Japan will not be allowed to build airplanes, although they may be permitted to buy and operate them within their own borders.

'COPTER FOR CARGO OR CASUALTIES

First helicopter built for military transport-cargo duties is P-V Engineering Forum XHRP-1 (or PV-3) sponsored by Navy for evacuation of wounded men by air from otherwise inexcessible spots. With 48-ft. long fuselage odd-shaped craft is stated to have capacity of crew of two plus ten passengers. Power is furnished by a Continental-Wright R-975 engine. Postwar use as air-taxi, feederliner, or in mining is seen by company. Special rotor placement is called first successful usage of this type of design.

★ ASSEMBLY LINES ★

Boeing has built 2,075 Superforts at Seattle-Renton and Wichita plants, plus equivalent of 149 more B-29's in spare parts. More than four-fifths of craft were made in past twelve months.

Menasco started production on approximately 3,000 light aircraft engines for military use. All information on engine is restricted, but company emphasizes that it is not an auxiliary engine.

Convair's Allentown div. received additional orders for company's TBY Seawolf torpedo-bomber. . . Concern's San Diego div. has saved over three and a half million man-hours, representing over $3,600,000, as a result of employee suggestions. Employees turned in more than 4,000 suggestions, of which 1,726 were accepted.

Luscombe production for first four months of '45 was more than double that of same period last year, and company has increased Trenton factory area by more than 37%.

Minneapolis-Honeywell has produced 59,149 autopilots, 603,775 turbo - regulator instruments, 28,813 inclinometers, and 25,229 pressure transmitters for fuel lines.

Wright Aero Corp. is now employing 2,400 physically handicapped workers. These workers absenteeism, accident, and turnover records are reported negligible in ratio with those of physically able workers.

Eureka Vacuum Cleaner Co. has started production on electric control motors for Lockheed P-80's.

Eclipse div. of Bendix has produced over 22,000 automatic aircraft cannon and more than 52,000 magnetos.

Fairchild's C-82 contract has been doubled and put on a fixed-price basis.

Interstate Aircraft & Engineering Corp. has produced its 100,000th bomb shackle.

★ FOR THE RECORD ★

Solar Aircraft Co., San Diego, has purchased precision casting div. of B. F. Hirsch, Inc., N.Y.C., and Edmund T. Price, Solar pres., has been named in charge of Solar Precision Castings, Inc., subsidiary to handle new firm.

Columbia Aircraft Products, Inc., Somerville, N. J., has purchased plant and machinery of Palmer Brothers Engines, Inc., of Cos Cob, Conn. Marine engine output at latter plant is to be continued.

O. S. Tyson & Co., Inc., has been awarded advertising contract for General Aircraft Equipment, Inc., So. Norwalk, Conn.

Goodyear Aircraft Corp. has started construction on a 3,000-ft. sod runway for heavier-than-aircraft at company's Wingfoot Lake airship base. Runway is to permit operations of company's planes, in addition to airships.

Square D de Mexico, S.A., which plans to manufacture electrical distributing and control equipment for Mexican market, is completing its organization. A plant is to be built in Mexico City, D. F. Concern will be owned jointly by parent company and Mexican industrialists.

Keller Tool Co., Grand Haven, Mich., has appointed Dawson Machinery Co., 2737 First Ave. So., Seattle, as a new distributor in that territory.

Nathan Mfg. Co., of New York City, has formed a subsidiary, Nathan Aircraft Devices, Inc., planned as development and production of devices for use on aircraft engines.

★ CALLING NAMES ★

(*Continued from page* 207)

ard Kimball has been promoted to system mgr. of company's news organization.

Clyde C. Bohner was named v.-p. of Lawrance Aero Corp.

L. C. Goad, general mgr. of Eastern Aircraft Div., GM, was elected to corp.'s administration committee.

Maj. John T. Stickney has been appointed EAL's supt. of passenger service.

Kenneth MacGrath has been elected pres. of Air Associates. TACA elections: **Webster B. Todd** has been named a director; **Wesley J. Wilson** was made general traffic mgr. for TACA Agency; and Eileen Roddick-Roberts has been appointed passenger traffic mgr.

Leigh R. Murphy has been made supervisor of operations for PCA.

R. D. Kelly has been named chairman of UAL's patent conference. Other members are: **S. P. Martin, J. R. Cunningham, Fred Hambrick, Jack Rothman, Al Pendleton,** and attorneys **Floyd Rett** and **Thomas H. Daly.**

Paul F. Collins, who was re-elected pres. of NEA, has also been named board chairman, and **H. LeRoy Swimm,** company treas., was elected a new director. Stockholders also made **Richard Ely** corp. clerk.

P. G. Caldwell and **E. A. Leach** have been named sales managers of GE's electronics dept. sales div.

George S. Garrard was named chief engineer of Briggs Clarifier Co.

Arthur E. Welch was elected v.-p.-treas. of Aireon Mfg. Corp., and **Ralph E. Middleton** became v.-p. in charge of engineering.

Robert G. McLain has been named mgr., air express, eastern depts. of REA.

Theodore W. Gibson was appointed supt. of maintenance for Braniff.

Leo Baron, formerly of TWA, has joined John A. Cairns & Co. **George Ford** has been placed in charge of Convair's Vultee Field div., and **Milton P. J. Hickey,** of Stinson div., was elected to Controllers Institute of America.

B. F. Goodrich appointments: **Earl R. Kambrich** has been transferred to Los Angeles district as sales representative; **John W. Oakes** has been shifted to Dayton office; **R. L. Custer** has been changed to industrial products sales, Detroit district, and **Joe E. Earll** has been named district mgr. of automotive and aviation divs.

Ernest C. Breisford has joined Thompson Products as asst. to v.-p.-treas.

W. H. McCoy has been appointed factory mgr. of Packard's Toledo aircraft engine div.

James R. Allen has been elected v.-p. in charge of coordinating engineering and production for Union Aircraft Products Corp.

John C. Lee has been named to board of Radiolane Co.

H. T. Sagert has been named Lear's chief of aircraft radio customers service, and **George Tharratt** has been appointed general mgr. of company's California div.

William T. Gossett has been elected general counsel of Bendix Aviation Corp.

Russell G. Akin has been appointed director of sales and advertising for Littelfuse, Inc.

Alan G. Binnie has been named asst. general mgr. of Kollsman Instrument div., and **Philip F. Weber** has been appointed factory mgr. in charge of all mfg. operations. **Joe Miller** was made v.-p. of Candler-Hill Corp., div. of Titan Pump & Engineering Corp.

This transport gets EXTRA STAMINA from seamless tubing

SHELBY Seamless Tubing construction of the Constellation's main landing gear.

YOU'RE looking at America's largest, fastest, most powerful cargo or transport plane. This giant new Lockheed Constellation can cross the continent non-stop in less than 9 hours, fly to Honolulu in 12. Powered by four 2,200 horsepower engines, its cruising speed at 65% power is over 300 miles an hour. It can fly, climb and land on three or even two of its four engines. It can carry 64 passengers and a crew of six in a cabin that is pressurized for flight 20,000 or more feet—"above the weather."

Like many other super ships of the world's greatest air fleet, the Constellation has attained maximum strength and minimum weight through the extensive use of Seamless Steel Tubing. No other form of construction has a higher strength-weight ratio for engine mounts, landing gear, wing spars, longerons, fuselage struts, and tail assembly.

All SHELBY Seamless Tubes are made to exacting government specifications and are available in a complete range of sizes and shapes in the current range of alloys.

SHELBY SEAMLESS *Aircraft Tubing*

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

NATIONAL TUBE COMPANY · USS STEEL · UNITED STATES STEEL

UNITED STATES STEEL

Tally U. S. Airline Peace Fleet at 975 Planes Via 409 New Craft; 19 Major Lines on Roster

. . . Interim Agreement effected as 30 nations sign . . . Lea measure aims to define state-federal air control . . . PAA plans early reopening of Pacific commerce runs . . . New bill seeks to remedy multiple tax on carriers . . . Deaf ear to RR arguments . . . People negate feeder delay . . . New CAR revise up.

Nineteen U. S. lines expect to have 975 planes with improved accommodations and increased speed, seating 36,180 passengers, the Air Transport Assn. finds in a survey gaging our transport objectives. To reach this goal, the lines will purchase 409 new aircraft, seating 23,275 passengers.

Of the new planes ordered, more than 200 are to be four-engined types. Prospects for substantial deliveries in 1946 are good. Planned purchases total about $300,000,000. In five years, ATA estimates the total will reach $750,000,000.

Planes ordered, or under consideration, include Douglas DC-6 and DC-7, Curtiss CW-20, Martin Mars flying boat, Lockheed Constellation C-69, Boeing Stratocruiser C-97, Consolidated Model 37, Martin Mercury, the Fairchild C-82 Packet, and others.

The airlines have vastly increased their capacity by increasing flight hours per day from 6.35 in 1941 to 11.39 at present. Last Spring, with just under 300 airplanes, the airlines were averaging 160,839 mi. more daily than they were in 1941 with about 65 more airplanes, or a total of 359. Thus plane utilization has been improved by 79%.

Operators' policy, facing a period of expansion, is to rehire all former employees returning from the armed forces, and to fill many additional jobs with veterans. They now have about 50,000 employees, as compared with 26,000 in 1941, and they expect to run the total up to 150,000 in 5 yr. ATA says that at present they need traffic office agents, avigators, flight engineers, radio operators, likewise numerous ground men in the operations and maintenance classifications. Pilot requirements are being met by discharges from the services.

The National Safety Council has made awards to 16 American airlines which had completed 1944 without any fatal accidents. Three had passenger mileages in nine figures: United, 464 million; Eastern, 273; and Northwest, 121.

Interim Agreement Effected As 30 Nations Sign

The State Department announces that the Interim Agreement on International Civil Aviation, adopted at Chicago, is now in effect, as 30 governments have officially accepted it. Only 26 were required to put the pact in force.

Seat of the world airlines government will be at Montreal. It will consist of an assembly in which all signatory powers will be represented, and it will have a council of 20 members serving two years.

The interim organization has no power to regulate route certification, competition, or rates; it has only advisory and technical functions.

Meanwhile the State Department has cited law to show that the U. S. has the power to participate in two-freedom and five-freedom (of the air) agreements, made at Chicago, by Executive action, without regard to the treaty-making powers of the Senate.

Lea Measure Aims to Define State-Federal Air Control

Rep. Clarence Lea, sponsor of aviation legislation in the House, having adopted a new strategy of offering single propositions for action, rather then the omnibus bill, has introduced a measure to define the jurisdictions of States and Federal Government in aviation control. The bill (1) would remove any doubt of CAA's and CAB's authority to regulate airplane safety in all aircraft; (2) exempt from Federal economic control all operators whose services are solely intrastate; (3) prohibit State regulation of domestic and foreign air carriers unless provided for by Congress; (4) authorize enforcement of safety regulations in State courts by State officers; (5) eliminate the legal distinction between "foreign - to - state" and "interstate" air transportation, calling them all "domestic."

PAA Plans Early Reopening of Pacific Commerce Runs

From PAA comes word that it may resume trans-Pacific commercial service by Jan. 1, 1946, or before. Pacific operations were suspended at the time of Pearl Harbor and placed under contract to NATS. Company is now the only airline contractor to Navy.

Most of PAA's contract flying for the Army is on the Africa-Orient division, based on Miami and New York; it flies everywhere eastward, has crossed the Atlantic 5,000 times, and has carried 100,000 passengers and 40,000,000 lb. of mail and cargo.

New Bill Seeks to Remedy Multiple Tax on Carriers

A bill has been introduced in Congress by Rep. A. L. Bulwinkle providing against multiple taxation of air carriers by the several States. The measure is offered following the Supreme Court's decision in the case of NWA vs. Minnesota, and is based upon facts given in a report to Congress by the CAB on multiple taxation.

The bill proposes that any state tax based upon an air carrier's total operating property revenues, investments, etc., shall be unlawful. It sets up a formula under which the State's taxes would be prorated upon business originating in and arriving in the said State.

Congressional action may be long delayed, because the airline's case is only part of an intricate problem in the allocation of tax sources between the States and the U. S. Government.

'CHUTING FOR DELIVERY BUSINESS

Package of dishes being examined by PCA Chief Hostess Katherine Hartman has just been delivered to ground from company's Douglas DC-3 airliner during a demonstration of special-'chute dropping of airmail and cargo from large planes at Washington National Airport, to explore possibilities of serving small communities without fields. Four runs were made at 140 mph., and parcels varying from 20–50 lb. were delivered from 200 ft. Although contents included dishes, phonograph records, and bottles of medicine, only one saucer broke in process. Cooperating with PCA was Switlik Parachute Co. Chute, packed in canvas sack, is attached to cargo. When pilot trips a trigger, cargo and chute come off a conveyor and static lines open canopy. (Wide World photo)

Deaf Ear to RR Arguments

The railroads, and to a lesser extent the steamship lines, continue urging Congress to revise the CAA so that surface transportation can operate airlines. They also demand that all forms of transportation be brought under the regulatory control of a single Federal agency, presumably the ICC. These representations are made by the Transportation Assn. of America, an agency of the railroads.

Congress and the White House do not appear disposed to consider either proposal at this time. The public is hopeful of air services within reach of all, and probably will not approve of any restrictive measures. Unit control over all transportation would include shipping, and that would involve a fight with the powerful U. S. Maritime Commission. TAA charges that airline dividends are being paid from subsidy-tax money.

ATA reports that Post Office revenue from airmail so far exceeds the cost and that the airmail deficit of 25 yr. has been liquidated.

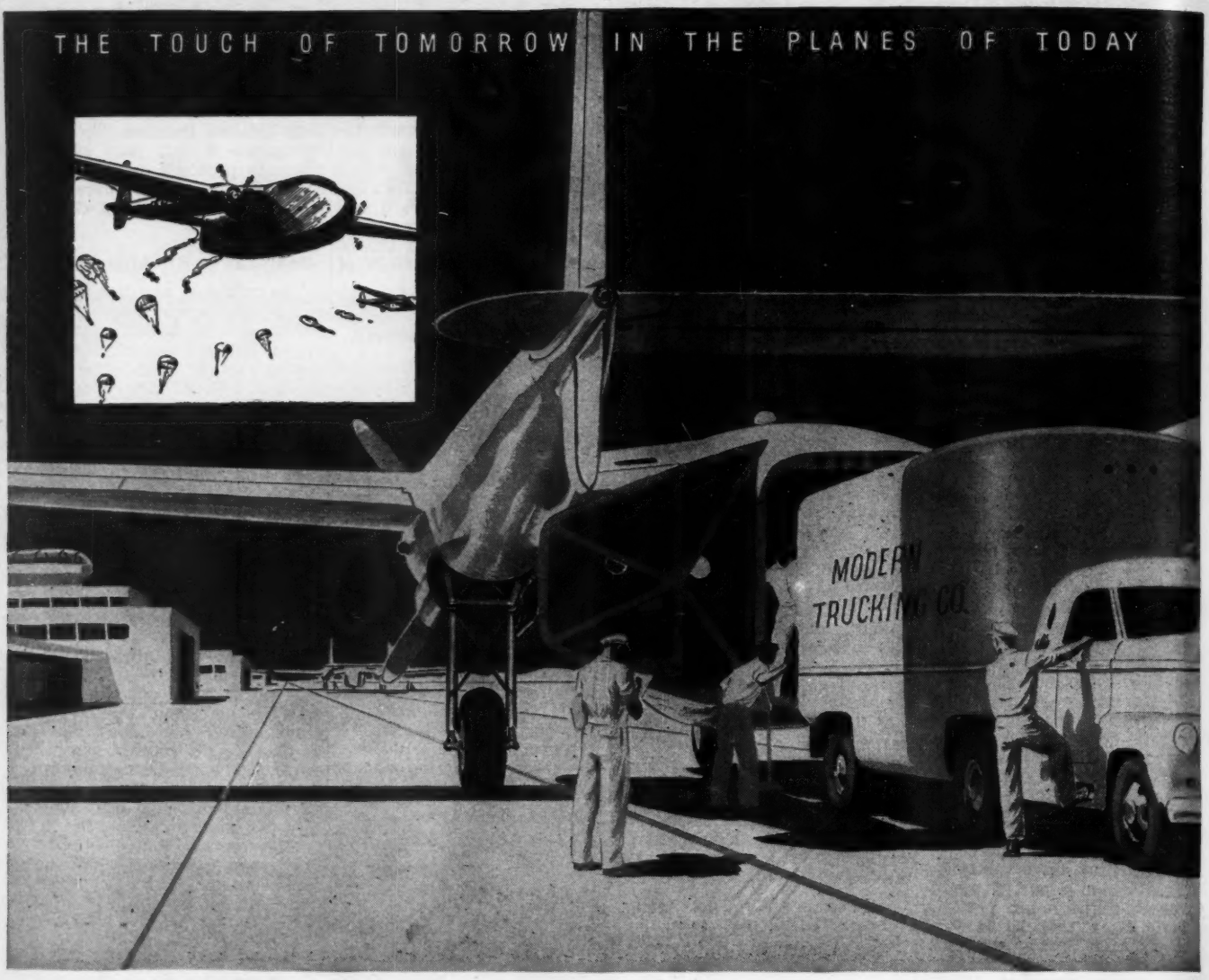
People Negate Feeder Delay

Although the Post Office Department and CAB have made public their opposition to rapid development of the shortline feeder services, it has been inevitable, all along, that small communities would use their combined political power in favor of immediate air service for most of the towns in this country.

Rep. Jennings Randolph, a strong spokesman in the House on aviation, points out that only 360 cities and towns, and only about one third of this country's population, are now served directly by the air system. He says that 2,500 applications for service extensions are pending before the Board, and he says, "It has never been the intention of Congress to limit our air transportation system to a relatively few major cities."

New CAR Revise Up

A change in Part .04 of the Civil Air Regulations, revising the airworthiness requirements of transport planes, has been distributed throughout the industry for comment, which is wanted by Aug. 3. Present Part .04 of CAR deals with both scheduled and non-scheduled aviation, whereas new one deals exclusively with sched-



A Ship of War—With a Peacetime Destiny

You won't have to beat this weapon of war into a peacetime plowshare. V-J Day will see the Fairchild-designed "Packet" ready to plow the airlanes of commerce.

Built specifically for military cargo—tons of guns, men and equipment for battle—the "Packet's" huge hold will receive the bulky goods of peacetime commerce with ease, speed them hundreds or thousands of miles to their destinations.

Designated by the Army as the C-82, the "Packet" has been nicknamed the "flying boxcar." Its cargo compartment (2,870 cubic feet of unobstructed and continuous space) carries 93% of the capacity of a railroad boxcar.

Facility in loading is a triumph of Fairchild design. Split doors at the rear of the fuselage open to the full width of the cargo space. Cargoes roll smoothly into the "Packet" from a truck, for the "Packet's" horizontal floor is at standard truck floor height. Smaller pieces can be loaded through a forward loading door.

The value of the "Packet," to shippers of all types of "flyable" cargo, will be as broad as the future of air cargo itself. Time and experience will attest to its economy and multiplicity of uses. Thus, the "Packet," now at war, emphasizes the Fairchild tradition of advanced aviation, "the touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

Fairchild Aircraft

Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland

uled aircraft airworthiness. After comments are received, CAB will hold a series of meetings with representatives of interested groups.

A new Part .03, covering non-scheduled exclusively, is at present being circulated (see story on page 208 of July AVIATION).

★ CROSS COUNTRY ★

ATA predicts: That six billion passenger-miles will be flown in '46, compared with current two and a quarter billion; a quarter million passengers will fly to Europe per year soon after V-J; 8,000-12,000 pilot and crew members will be employed by airlines, plus 125,000 ground workers, three times present payroll; there will be 63,000 operations jobs on airports plus 125,000 jobs directly connected with airport activities; all first class mail will go by air; parcel post will also be carried by air; volume of air express will exceed passenger revenue and there will be nearly 6,000,000 potential new air passengers.

AEA carried first commercial cargo from N.Y.C. to Botwood, Newfoundland. Airline is now accepting air shipments without priority to Newfoundland, Eire, England, Scotland, Wales, and Northern Ireland.

New procedures to assist airlines and war industries owning transport planes in keeping craft flying through procurement of spare parts have been developed by RFC-AAF. Under new system, an airline or company engaged in, or supporting, war production, will direct an application for needed parts to Aircraft Div., Office of Surplus Property, RFC. If desired parts are not available from RFC stocks, AAF will search its surplus stocks, then ship available items directly to airline or company making request.

AA'S NEW TYPE BINNING UPS DC-3 PAYLOADS

Interiors of AA's Douglas DC-3 Airfreighters now have a new layout, featuring thermostatic temperature controls for transportation of perishables and facilities for hauling of large boxes and crates. There are seven cargo bins, measuring 37 x 44 x 75 in., each able to contain units up to 750 lb. Removable web gates (left) permit flexibility in enclosing oversize crates. Magnesium alloy poles separate each bin. Old-style bins could only hold 500 lb. each. It is stated that design gives planes largest interior floor space of any commercial air-cargo craft, and permits carrying hitherto impossible loads. New Davis-type tie-down equipment for holding containers too large for bins is seen at right.

KNILM has placed orders for several Lockheed Constellations in preparation for resumption of airline's services to Netherlands Indies. Netherlands have already acquired 37 bases for use of projected service to Far East following defeat of Japan.

PAA announces availability of 50 seats on two of company's four weekly trans-Atlantic Clipper flights. Only requirement is passport and visa, however tourist or pleasure hops are not permitted. . . With start of night flights to Havana, airline increased schedules between Cuban capital and Florida to 56 flights weekly. . . Company resumed service to Ketchikan, Alaska, running 16 round trips weekly connecting Seattle, Ketchikan, and major Alaskan cities . . . Inaugurated were three all-cargo Clipper flights weekly from Miami through Camaguey, Cuba; Port au Prince, Haiti; Ciudad Trujillo, Dominican Republic; and Curacao, NWI. . . Another new cargo service was started between Miami and Rio de Janeiro, with stops en route at 12 cities throughout Caribbean and along east coast of South America.

Trans-Marine Airlines, N.Y.C., began inaugural flights between N.Y.C., Martha's Vineyard, Nantucket, and Cape Cod area, using Lockheed Lodestars. Line is headed by Hobart A. H. Cook.

CAA recently demonstrated fan marker approach system to airline representatives and a member of Airline Pilots Assn. Exhibit indicated that airplane landing time under adverse weather conditions could almost equal good weather time, reducing present adverse weather landing time by over 50%. Under new method, arriving planes are stacked over a fan marker about 10 mi. from field. Starting that far out, pilots come in on range leg in a straight-in approach, pass over range station at final approach altitude, then make normal landing. Usually planes have been stacked over range station, and it is believed that with VHF equipment, landing time can be further reduced.

Six different types of airport approach lighting are under test by CAA at Indianapolis Municipal Airport. CAA hopes to find answers to many lighting problems, and to determine what type of runway and field lighting is best for instrument flight, regardless of weather. Experimental system is so installed that alternate systems may be switched on and off for comparison during tests of the varied equipment.

Furnishing a joint radio communication station for five airlines operating at Logan Airport, Boston, Aero Radio Corp. plans use of one such type station for all airlines on one field instead of multiple operation of licensed radio facilities, because of crowding of radio spectrum and fact that nearly all bands have been allocated. A similar Aero Radio Corp. project is under way at Toledo.

NAL received CAB authority to fly non-stop from Miami to Jacksonville on company's N.Y.-Miami route . . . Line's subsidiary, Caribbean-Atlantic Airlines, began flights between San Juan, Ponce, and Mayaguez, Puerto Rico, and added service into St. Thomas and St. Croix in Virgin Islands.

TACA renewed mine contracts with La Luz Mining Co. and Neptune Gold Mining Co. in Nicaragua. Contracts are to run for five years. Both mines are accessible only by TACA planes, which since 1936 have carried more than 70,000,000 lb. of freight. Construction is to begin on two 4,000-ft. runways at each mine to accommodate increased business.

FOR EASIER FABRICATION AND LOWER COSTS--

Carpenter

STAINLESS TUBING

★ You save 15% to 40% with this type of tubing.

★ Uniform walls permit easier fabrication, fewer rejects.

★ Lighter gauges can be used, for faster fabrication.

You get all those advantages, *plus* the design features you expect from Stainless Steel ... strength with light weight, corrosion and heat resistance.

When you want the advantages of Stainless Tubing—at a saving—call Carpenter. We'll be glad to put our diversified experience to work on your engineering and fabricating problems. And meanwhile, ask for the Carpenter file folder of useful facts about Welded Stainless Tubing. It contains information on sizes, types and finishes available, and detailed engineering data. A note on your company letterhead will bring it to you.

THE CARPENTER STEEL CO.
Welded Alloy & Tube Division
Kenilworth, New Jersey

Carpenter
WELDED
STAINLESS TUBING

AVIATION ABROAD

★INTERNATIONAL BRIEFS★

ENGLAND—Vickers Warwick has been superseded by Viking, a twin-engined low-wing transport for 21 to 27 passengers. With gross and empty weights of 21,600 lb. and 33,000 lb., respectively, and 1,550-hp. Hercules engines, cruising speed of new craft is estimated at 210 mph. at 10,000 ft., for a maximum range of about 1,500 mi.

Three new fighters are announced by Britain—DH Vampire jetfighter (500 mph. plus), the Vickers Armstrong Spiteful, a Griffon-powered fighter (460 mph. plus), and DH Hornet, a fighter development of Mosquito, with two Merlins (470 mph. plus).

Brabazon I is going into production shortly. With a gross weight of 110 tons, it is designed to carry 72 passengers over 3,000 mi.

Short Shetland is shortly expected to make its first trans-Atlantic flight for BOAC. With gross weight of 130,000 lb., airplane is stated to have top speed of 267 mph. employing four 2,500-hp.-plus Centaurus engines.

Current British air magazine offers report that Vought is readying an experimental reaction-propulsion single-place fighter for test by U. S. Navy. Publication states power units will be provided either by P & W or Westinghouse.

Halifax transport conversion features a freight pannier, similar to freight trays which Swedes built into their converted Boeing Fortresses (let down on winches for loading). Most economical cruising of 68,000-lb. Halifax is gaged at 200 mph. at 10,000 ft.

DH Gipsy Major engines are now licensed to run 1,500 hr. between overhauls without intermediate top overhauls.

Our British contemporary "The Aeroplane," which mentioned "Douglas aircraft built in Holland," will be interested to know that Fokker plant in Holland, though licensed to build Douglas transports, actually never did. Company just collected 15% on all Douglas transports sold elsewhere than Russia and Western hemisphere.

FRANCE—Mockup of 28-cylinder Gnome & Rhone engine at Limoges was made of porcelain to facilitate smashing in event Nazis discovered this clandestine development.

Having now started a Paris-Nice service, France intends to add extensions to Corsica, Italy, Greece, and Damascus.

POLAND—Airline LOT has reopened its services, with DC-2 and DC-3 aircraft, carrying over 2,000 passengers in first month.

DENMARK—Airline DDL has been assigned three surplus DC-3's to start services in Scandinavia area. DDL's president recently visited U. S. West Coast plants, with possible Douglas DC-4 or Lockheed Constellation orders in mind.

NORWAY—Reports from Norway describe ex-German airport at Stavanger-Sola as one of largest in Europe. It's said it will need no change to handle expected AA-AEA transports.

SWEDEN—ABA line has reopened service to Paris and also to Oslo.

New airports with 6,000-ft. runways are being constructed at Norrkoeping and Upsala, also facilities at other existing Swedish airports are now being expanded.

RUSSIA—In addition to air service to Berlin, regular schedules have now also been established to Prague via Warsaw and Dresden.

TURKEY—An American mission has arrived in Ankara to prepare way for U. S. commercial airlines. Before war, lines generally avoided Turkey because of difficult regulations discouraging regular operations.

AUSTRALIA — A crisis has arisen regarding status of Guinea Airways since proposal to merge with Australian National was voted down. Present GA management has resigned, and company's financial position is reported as precarious.

Australian Senate has now been urged to allow establishment of an Australian airline to America, to make country independent of American or British companies over this route.

Qantas Airways, which carried over 43,000 passengers in '44, is training crews for its proposed 70-hr. Sydney-London service, to be operated with Lancastrians.

SOUTH AFRICA — Combined BOAC-South African Airways service to London with Yorks has been delayed due to poor condition of fields en route.

SOUTH AMERICA—Magazines here are being flooded by advertisements of English-made Tipsy and Chrislea Ace lightplanes. Transport plane builders are also well represented.

COLOMBIA—TACA de Colombia has started regular service between Bogota and Barranquilla with Douglas airliners. Other domestic lines are expected to open up soon.

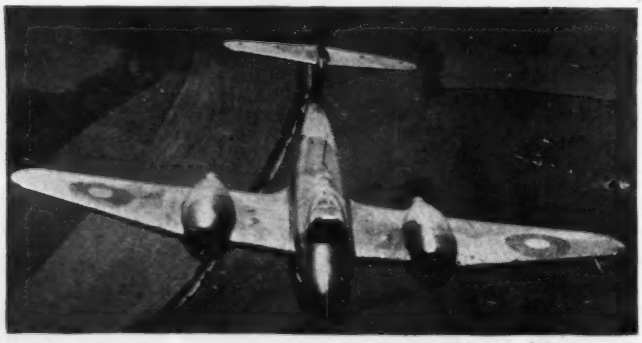
ARGENTINA—Another TACA subsidiary, Cia. Aerovias Argentinas, is shortly expected to start operations here. Projected are services to Oran, Comodore Rivadavia, and Iquazu, with Buenos Aires as main base.

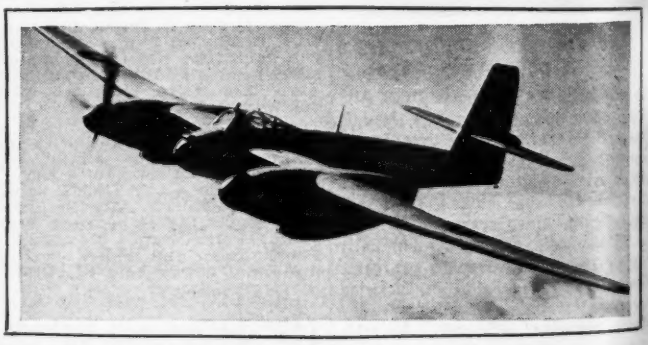
WORLDATA . . . . . By "VISTA"

Nationalization of all French airlines has become fact, and steps are already being taken for development of French civil airlines. Plans are based on a 5-yr. program designed to provide comprehensive air transport facilities for all trips of more than 200 mi. The French airline network is now said to cover about 52,000 mi., or nearly 50% more than in '38, and new aircraft are constantly being added to the fleet.

Among planes the French plan to employ are the Bloch 161 four-engine transport and the Latecoere 631 six-engine flying boat. Both were developed before France fell and, compared to American and British models, are not too modern. Planning to equip these airlines with domestic products, French designers have already projected a wide variety of craft. Aviation experts on both sides of the ocean have taken a keen interest in these developments, since they are indicative of possible future French competition. At the same time it is felt that the French military aviation mission, primarily looking over warcraft production in this country, will also show a lively interest in the newer American transports.

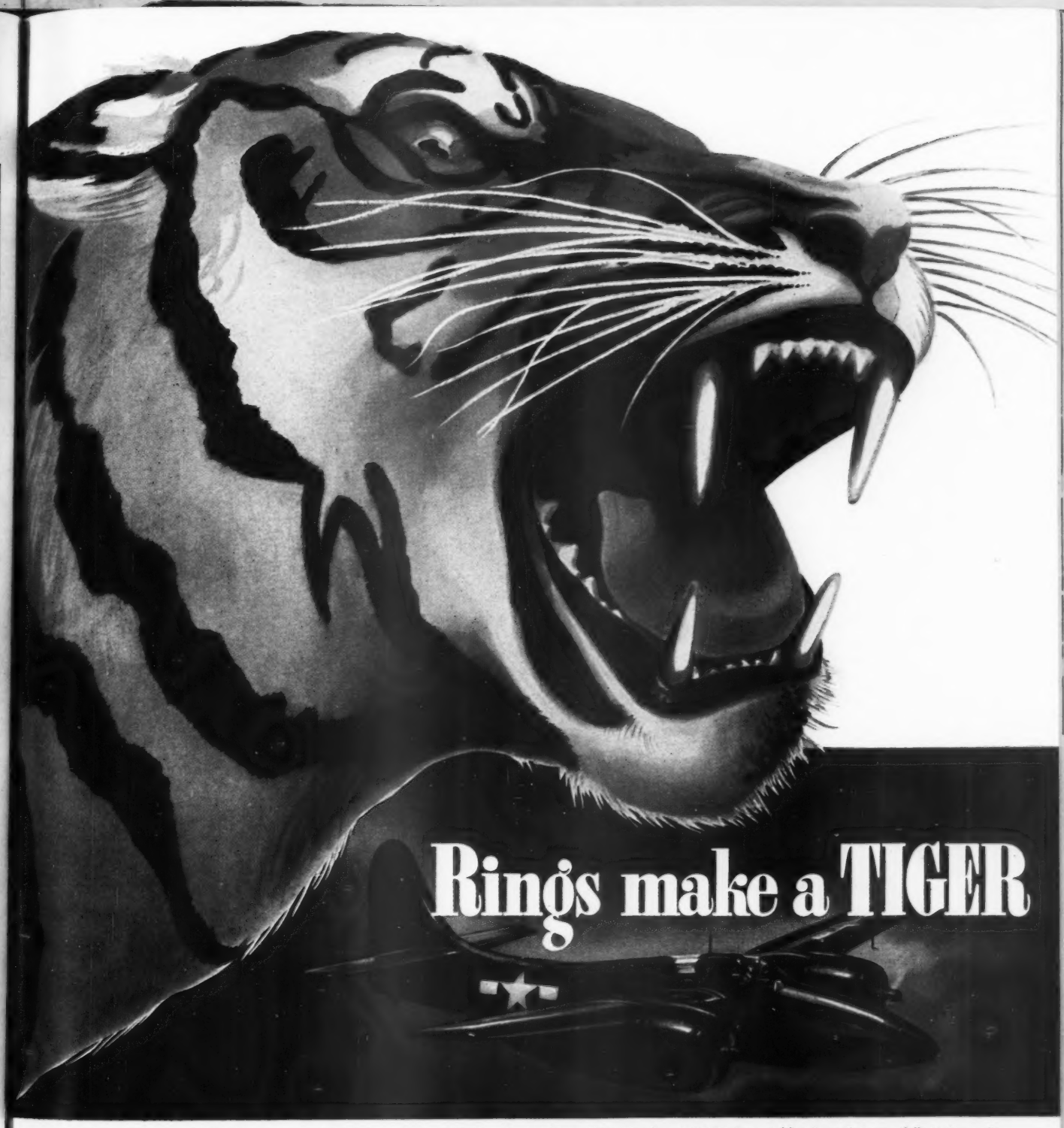
Granted, other countries seek to protect their national product, but there are few plants outside England and America, and possibly Russia, which can turn out commercial aircraft which could give countries with international airline ambitions a chance in the postwar scramble. Surveys and inquiries are now being conducted by both British and American officials as to the possible requirements of other-nation airlines, and lively competition is expected, England having a number of prototype craft which are similar in performance and capacity to American models. However, indications now are that price differences, generally favoring British planes, will force many foreign lines to purchase English aircraft. Some quarters feel that only the establishment of equipment trust financing for foreign companies will enable the United States to obtain a fair share of the foreign commercial plane market.



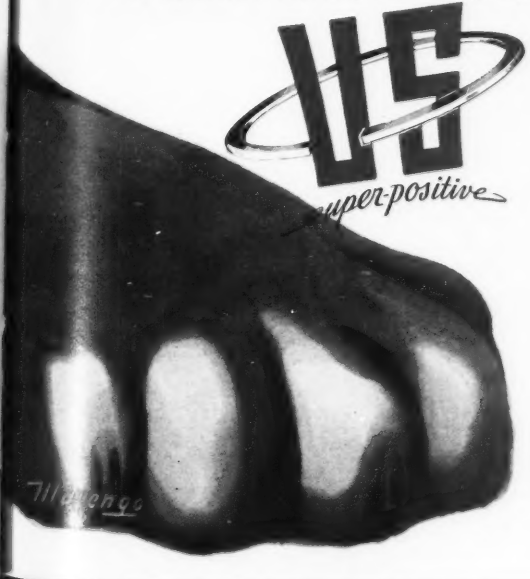


BRITAIN'S J-P METEOR AND HIGH-FLYING WELKIN

First Allied jet fighter to see action against enemy was Gloster Meteor single-seater (above) mounting two Welland or Derwent units, which are developments of basic Whittle design. Craft first went into combat against Nazi V-1's on Aug. 4, 1944, armed with four 20-mm. cannon in nose. Plane has 43 ft. span, 41 ft. length, 13 ft. height, and 374 sq. ft. of wing area. Horizontal tail surfaces are set high on fin to avoid blast from jets. Right: Westland Welkin is a one-place fighter for operations at stratosphere levels. Air pressure in armored pressure-cabin is automatically operated, and windshield clouding is offset by pumping of warm air between double panes. This air also heats cabin so that no special clothing need be worn even at —78 deg. With 70-ft. span and weighing 17,500 lb., craft is powered by two 1,650-hp. supercharged R-R Merlins. Top speed is given as 385 mph., and range is put at about 1,500 mi. Four 20-mm. cannon are in nose. (British Official photos)



THE NEW GRUMMAN F7F "TIGER CAT", Fastest climbing Navy plane, 60 MPH nearly straight up. Fighter-Bomber, 425 MPH, 2 tons of bombs, rockets or a full-sized torpedo.



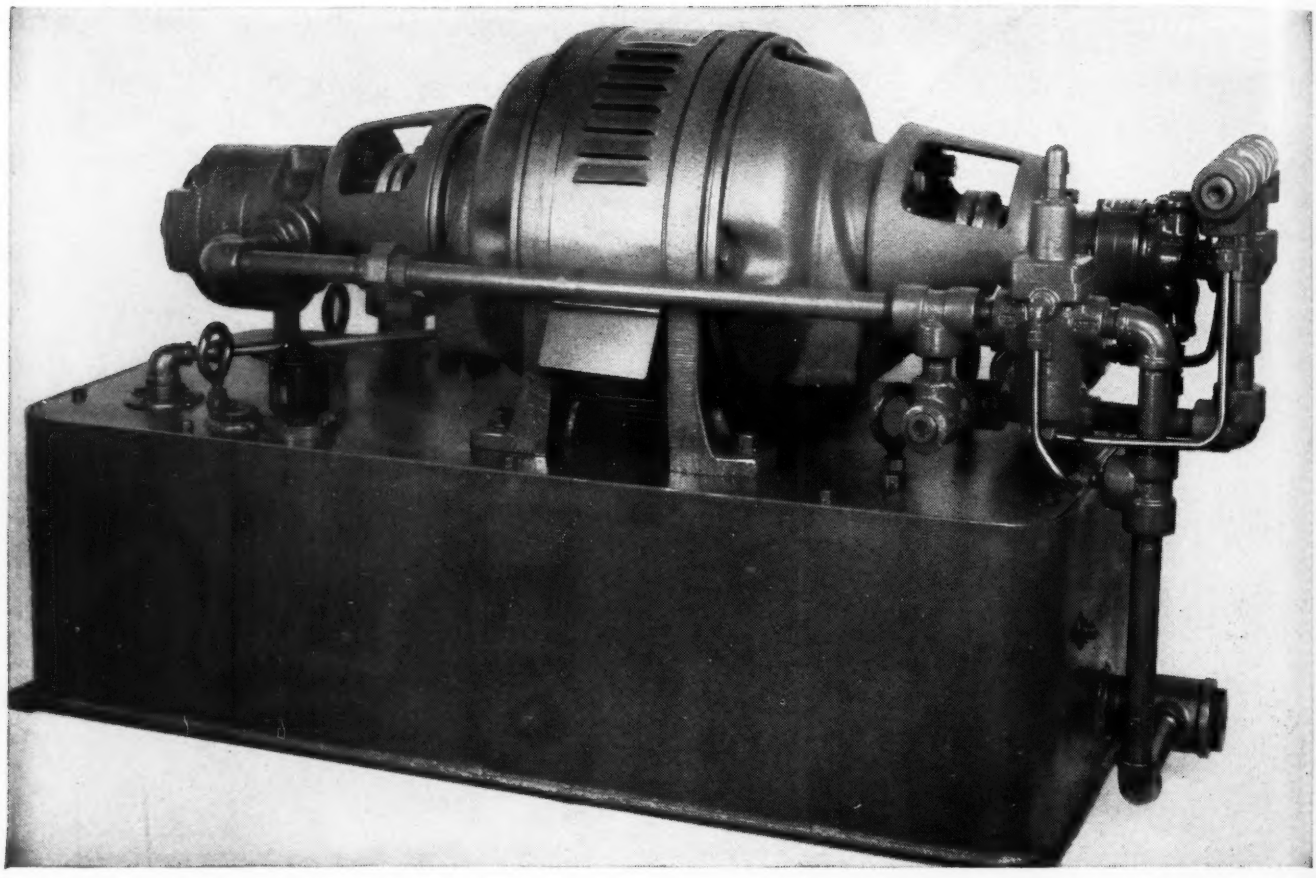
Rings Also Make An Aviation Engine . . . when they guard intake and compression with predictable cylinder seals. So dependably have U. S. HAMMERED PISTON RINGS served design, production and service engineers, that they have become known as U. S. Super-Positive Piston Rings. Wherever internal combustion engines are being developed for war or peace, there you will find U.S. Super Positives!

BIGGER BOND BUYS... FULLER BOMB BAYS

For predictable compression...
Specify U.S. Super-Positives

U.S. HAMMERED PISTON RING CO., INC.

STIRLING, NEW JERSEY, U. S. A.



HYDRAULIC POWER UNITS • 3000 P.S.I.

Packaged Assemblies Combining High Pressure Low Volume and Low Pressure High Volume Pumps and Valves for Manual and Automatic Control

PRESSES • CALENDER ROLLS • HYDROSTATIC TESTS • ROLL BALANCING
BROACHES • PRESSURE SEALS • FLOW TESTS • BEARING FLOTATION

Hy-Lo Hydraulic Unit

21 GPM • 3000 P.S.I.

These units have been in extended service in Rolling Mills • Textile Plants • Chemical Plants • Plastic Plants • Testing Laboratories • Research Laboratories • Rubber Plants • Powdered Metal Industry • Aviation Research • Airplane Manufacture for Standard Equipment and Production Test Procedure

3000 P.S.I. Pumps in Capacities of ½- 1- 2- 3 GPM • Hy-Lo Combinations 5 GPM and Up

•

Experienced Hydraulic Engineers Are Available Without Obligation

•

THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • FACTORIES: WATERTOWN, N. Y.

Fairchild Camera & Instrument Corp. reports 1944 net earnings of $1,039,074 or $3.08 a share compared with $1,229,465 or $3.65 a share in 1943. Company was using $7,800,000 of a $15,000,000 V-loan credit at end of '44. Credit expires on Dec. 31. While it is in force, according to Pres. Ogsbury, dividends are restricted to $1 a share a year. Sales in 1944 were $41,708,000 against $46,779,000 in '43.

Pan American Airways Corp. has filed a registration statement with SEC for 3,986,522 common shares whereby 1,993,261 shares will be offered stockholders on basis of one unit for each two shares held. Unit consists of one common share and a warrant to buy an additional share at an $18 price. PAA reports '44 income of $1,619,309 (81¢ a share) against '43 income of $1,929,764. Operating revenues were $41,610,325 against $38,182,139 in '43.

Air Associates reports '44 net income of $73,792 or 55¢ a share for six months ended March 31, against $259,512 or $1.92 a share in like '44 period. Sales were $6,151,026 compared with $6,853,217.

Lear Inc., in first public offering of its stock, has placed 450,000 common shares with a banking group headed by Kobbe, Gearhart & Co. Financing was arranged to cover in part postwar expansion plans.

Luscombe reports '44 net income of $161,385 or 46¢ a share. Sales were $4,017,916 against $3,229,252 in '43. Unfilled orders at end of '44 were at a new peak and have substantially increased since, states Pres. Klotz.

Solar Aircraft Co. has purchased the precision casting division of B. F. Hirsch, Inc. Pres. Edmund T. Price will head new firm, which will be called Solar Precision Castings, Inc., and will be operated as a subsidiary of Solar Aircraft.

Sperry Corp. has a reserve fund of $11,000,000 for handling its peacetime retrenchment program and for development of new commercial products, according to Pres. Morgan. Net income in '44 was $7,725,138 or $3.83 a share against a 1944 net of $7,598,343. Shipments eased off in '44 to $427,136,000 from $460,006,000 a year earlier.

Dividends: PAA declared an initial 25¢ dividend on new stock created by two-for-one splitup last February . . . Lockheed paid an interim dividend of 50¢ a share on July 3 . . . Sperry paid a $1 dividend on July 13.

Bendix Aviation reports net profit of $3,436,723 or $1.62 a share for three months ended Mar. 31 and net profit of $7,093,560 or $3.35 a share for the six months ended Mar. 31.

Brewster Aeronautical has effected a partial settlement of its claims with Navy, which has allowed it to pay in full its V-loan. No loans are now outstanding except a mortgage on Long Island City plant. Company is now doing a small amount of work on high priority war material.

Unfilled Orders: Northrop recently received a $25,000,000 war order which will require peaking of production through '46. Total unfilled orders are $146,000,000, largest backlog held by concern since spring of '43. . . . Air Associates unfilled orders on May 31 were $7,000,000. . . . Sperry Corp's. on May 31 were $233,000,000 against $359,000,000 a year earlier.

Airline Earnings: Northeast Airlines reports a 1944 deficit of $77,042 compared with a 1943 deficit of $96,950. . . . Western Air Lines reports March quarter net profit of $117,607 or 29¢ a share against $17,564 deficit in '44 period.

ADDING IT UP.....By RAY HOADLEY

Wall Street Rumors. Strength in the aircraft stocks has been accompanied by more than the usual run of rumors, and the negotiations between Beech and Cessna with view to a merger served to heighten the gossip, even though this planned combination didn't pan out (see accompanying news story). There were reports of a possible tie-up between Solar Aircraft and the Elliott Co. However, it later appeared that although there may be some manufacturing relationship between the two, no merger seems in prospect. Then there was a report that Boeing might combine with another concern. Again there appeared nothing authoritative about this story.

Airline Investment. As Congress isn't likely to let the shipping lines fly the Atlantic, U. S. Lines has done the next thing by purchasing 52,000 shares of Pan American Airways (the old stock). Air transport, in the view of Pres. Basil Harris of U. S. Lines, will follow the course of the automobile industry, with three or four companies eventually leading the field. This calculation explains his purchase of a big block of Pan American, with whom his company has a close working arrangement in Europe, its agencies representing the airline.

War Plants. Sharply lower rentals than those proposed by the Surplus Property Board are needed if the aircraft industry is to use any very substantial part of the vast facilities built by Defense Plant Corp. The present formula provides for annual rental of around $1.40 a square foot on war plants leased to industry. On the other hand the most that many aircraft manufacturers feel that they can pay is 40 to 50¢ a foot. If these war-built aircraft properties are to be utilized, a special rental formula is imperative. The security angle alone should be enough to induce the government to make attractive rental arrangements with the industry.

Tax Aid. The Bureau of Internal Revenue is liberalizing its stand on deductions by war contractors for reconversion expenses. This is of interest to aircraft stockholders, since it will permit the industry to charge off a considerable portion of its reconversion costs to current business expenses rather than to capital costs as before.

The Reconversion Act. When the War Mobilization & Reconversion Act was passed by Congress last year it was lightly regarded by industry leaders. Now, however, it appears that under the law all war contracts—even those for experimental and development work—will be promptly cancelled on V-J Day. The result might be many months without military work for the industry, unless Congress gets busy now on a postwar aircraft program. Technology would suffer.

Merger Developments Highlight Finance Front

Beech-Cessna hookup off. Details revealed on Avco-Crosley, NA-Caribbean, and Jacobs-Republic Industries combinations.

After carrying plans for a merger into considerable detail, Beech Aircraft and Cessna Aircraft have announced that their negotiations to combine the two organizations have been dropped due to unexpected war production complications which have made the merger impractical at this time. However, certain projects for mutual utilization of facilities will be continued on a subcontract plan, and cooperation in conversion to peacetime manufacturing is also in view. Manufacturing economies and enhanced working capital had been specified as the goals of the planned merger of these two Wichita companies. Likely, the merger negotiations will be renewed at some future date, though no further moves are planned at present.

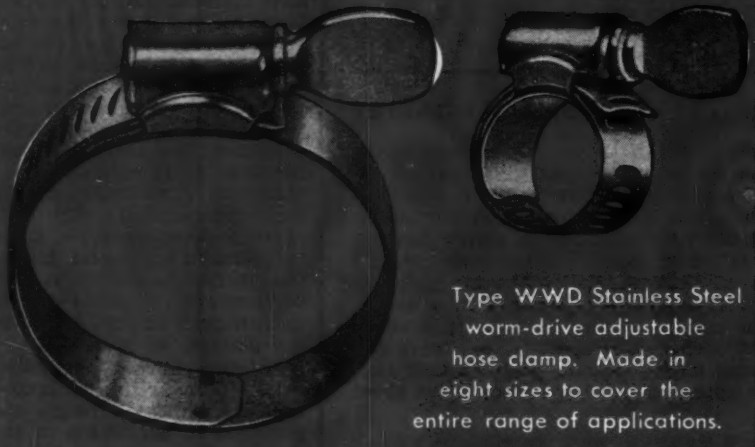
Aviation Corp. is rounding out its postwar line of household appliances through the purchase at $22,000,000 of the Crosley Corp. Around 64% of Crosley's 545,800 shares were purchased from the Crosley family, and a similar offer has been made to minority stockholders. Avco has arranged a bank credit with ten banks to finance the deal. The Crosley lines include radios, refrigerators, ranges, heaters, and kitchen equipment.

National Airlines has filed application with CAB for control of Caribbean Atlantic Airlines. Caribbean has 41,700 shares of stock outstanding, of which 80% has been deposited with National for exchange into latter's stock upon receipt of CAB approval. Terms of merger were not announced.

Republic Industries, Inc., is the new name of Continental Engineering & Management Corp. which recently acquired 85% of the Jacobs Aircraft Engine Co. stock (July AVIATION). It is noted that this Continental organization had no connection with Continental Motors. The engine firm will now be known as Jacobs Aircraft Engine Co., Div. of Republic Industries. Merger terms called for exchange of three shares of Jacobs stock for one share of $25 par 5% cumulative preferred stock of Republic. Each of latter shares will be convertible into three of Republic common up to 1950.

For Utmost Dependability...

WITTEK *Aviation* HOSE CLAMPS



Type WWD Stainless Steel worm-drive adjustable hose clamp. Made in eight sizes to cover the entire range of applications.

Type FBSS Stainless Steel hose clamp. The most widely used hose clamp in the aviation industry. Made in the standard AN 748 sizes . . . also additional sizes for special requirements.

Dependability has been recognized by the Wittek Manufacturing Company during its 25 years of hose clamp manufacturing experience as a foremost requirement in any hose clamp design. Wittek assures this dependability by the selection of basically sound designs . . . the use of high-grade materials and the application of good workmanship. Today Wittek offers two distinctly different hose clamp designs—each of which meets the requirements of Specification AN-FF-C-406 A.

TYPE WWD—an adjustable worm drive hose clamp made of stainless steel and designed to take full advantage of the superior physical properties of that material. Note the compact streamlined housing . . . the hardened one-piece thumbscrew—PLUS a new exclusive Wittek feature—an inner band of Stainless Steel accomplishing the two-fold purpose; (1) protecting the hose from the serrations in the outer band, and (2) distributing the load uniformally to provide greater strength and superior sealing characteristics.

TYPE FBSS—an improved Stainless Steel version of Wittek's basic FB design—now incorporating a bridge extender—in all sizes. This is the most effective hose clamp for all applications where an adjustable clamp is not necessary.

Hose Clamps for all requirements, made by Wittek—specialists in hose clamps and their applications.

ARMY E NAVY

War Bonds for Victory . . . Buy More Than Ever Before!

WITTEK
MANUFACTURING CO.
4505-15 W. 24th Place, Chicago 23, Ill.

Aviation HOSE CLAMPS

WILLIAM D. KENNEDY has been named vice-pres. and general mgr. of Wright Aero Corp. He is also vice-pres. and mgr. of company's Cincinnati plant. He is a veteran of more than 25 yr. in aviation and aircraft engine manufacturing and was closely connected with many famous flights.

GEORGE H. WOODARD, mgr. of Westinghouse's Aviation Gas Turbine Div., received company's Order of Merit in recognition of his work in development of new products. Before his present post he was mgr. of company's new products div. at E. Pittsburgh. He joined Westinghouse in '36.

C. R. SMITH (left) was elected chairman of board of AA, a newly created position. He served as pres. of airline from 1934 to 1942, resigning in '42 to enter military service as chief of staff, then deputy commander, of ATC. He received DSM, Legion of Merit, Air Medal, and participated in Distinguished Service Citation for transport of supplies to China. **RALPH S. DAMON** (right) was elected pres. of AA. Formerly pres. of Curtiss Aeroplane & Motor Co., he left that position in 1935 to become airline's vice-pres. of operations. He is also a member of board of directors of the airline company.

COL. BERNARD F. JOHNSON, released by AAF, has returned to head Aviation div. of Calif. Texas Oil Co. Formerly Petroleum Products Supply Officer, AAF Command, ETO, he was awarded Legion of Merit and was also decorated by French Government. He holds a pilot's rating.

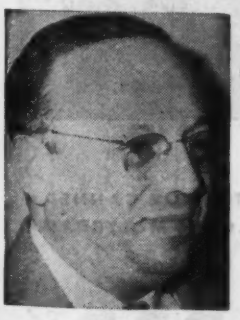
WILBUR W. BRADLEY has been made supt. of operations for new South American airline, TACA de Colombia. With 16,000 hr. to his credit, he has been flying since 1916. He formerly was operations mgr. of Avianca, PAA's Columbia affiliate. He also served with RAF in '16.

LT.COL. GEORGE T. CUSSEN was named EAL's asst. to general mgr., with hq. in N.Y.C. He had been operations officer for 302nd Transport Wing in England and in Paris. He was also stationed in Brazil and Africa, working on air transport problems. (Bachrach photo)

TAINE G. McDOUGAL, head of sparkplug div. of AC, received Ohio State University's 1945 Lamme Medal for achievement in engineering and technical arts. He is credited with development of monolithic sparkplug insulators for high altitude operations. He joined AC 30 yr. ago.

WILLIAM E. AMLONG has been appointed executive asst. for CAL. He came to airline from Colorado State C. of C., where he had been asst. mgr. since '40. Previously he was district mgr. of Ohio State C. of C. and before that was field secy. for California State C. of C. He is a member of NACOS.

PEYTON M. MAGRUDER has been appointed director of commercial sales for Glenn L. Martin. Well known for his design work on B-26 Marauder, he was previously chief of new design. He will now handle domestic and foreign sales of both aero and non-aero products.



NASH RUSS has been elected pres. of Taylorcraft. Also on company's board, he is likewise pres. of Detroit Aircraft Products and Detroit Aircraft Corp. Latter, a pioneer aero firm, at one time controlled Lockheed, Ryan, and other air interests. Company built first all-metal airships.

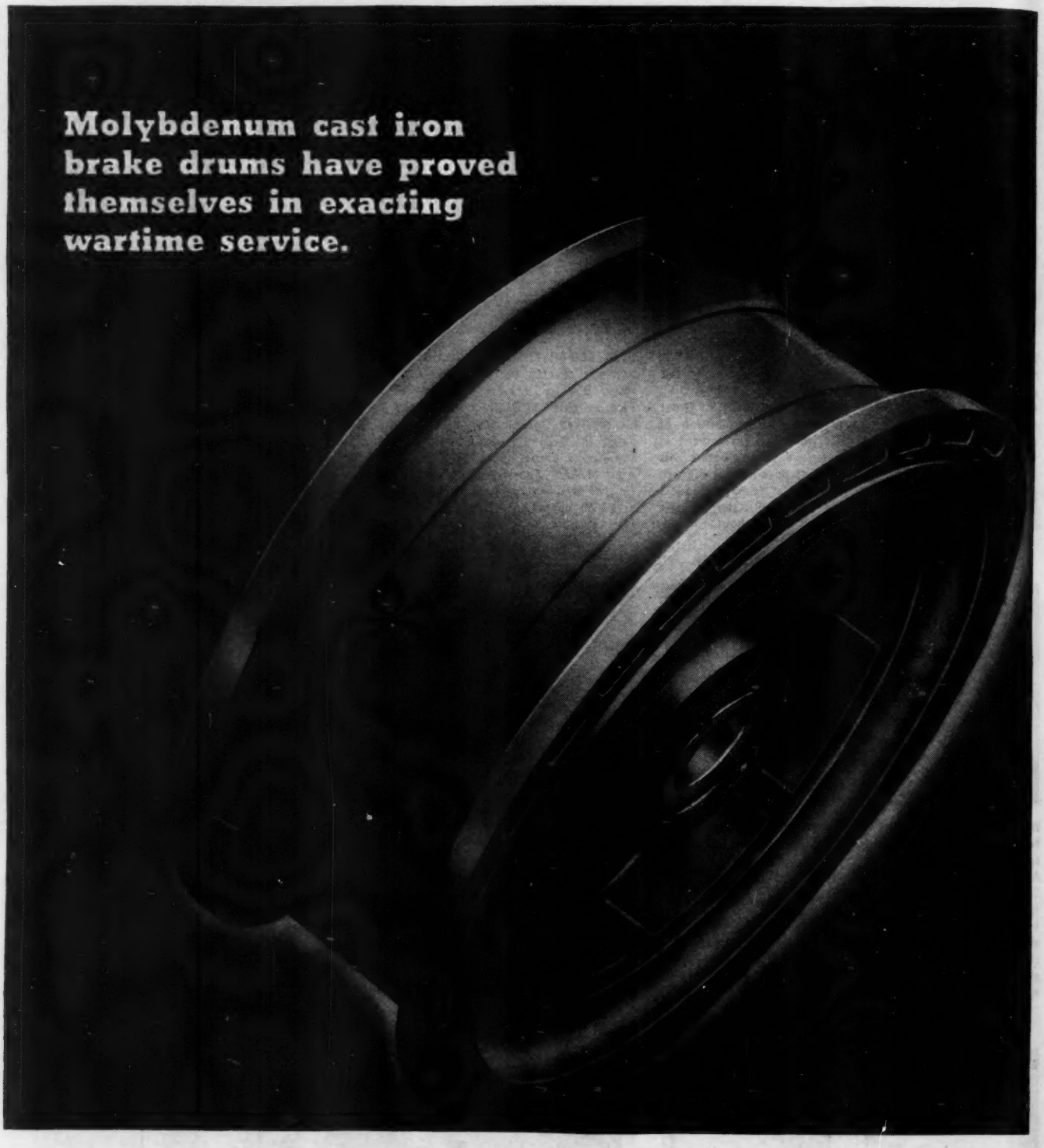
DONALD S. RUSSELL has been named director of contract administration for Bell's Niagara Frontier Div. He is expected to handle company's RP-63 armored target plane program. He was chairman of Target Airplane Evaluating Committee which helped develop RP-63.

WILLIAM I. BEACH, chief plastics engineer for NAA, received John Wesley Hyatt Award, top honor in plastics field, for his original thinking and research in development of a plastics forming process deemed competitive with the metal forming techniques. He joined NAA in 1939.

EDGAR RHODES is new asst. chief engineer of Ryan. He will have charge of engineering administration and will handle all production and other engineering concerned with company's new fighter. He was formerly chief project engineer on Bell's P-59A Airacomet jet plane.

JOHN L. SULLIVAN was sworn in as Asst. Secretary of Navy for Air aboard Adm. McCain's flagship carrier. Asst. Secy. Sullivan replaces Artemus Gates. It was first time an Asst. Secretary of Navy of United States has taken oath of office in a war zone at sea. (U. S. Navy photo)

Molybdenum cast iron brake drums have proved themselves in exacting wartime service.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue • New York City

MOLY

NEW PRODUCTS

KEEP POSTED ON

Products and Practices

INFORMATION TIPS

This selected information on new publications and products is offered by the "AVIATION" Reader's Service through cooperation with the manufacturers. It helps executives save valuable time, provides profits through convenience. To obtain literature or additional data on new products described, simply fill in form below, clip it to your letterhead, and mail. There is no cost, no obligation.

ENGINEERING DATA

Surface Inspection Apparatus.....1

Circular from Rex D. McDill, Cleveland, describes new comparator apparatus, Model C-1000, complete projection booth containing twin microprojectors, enabling comparison and inspection of "Faxfilm" slides at full 100 dia. magnifications, alongside "Faxfilm" standards.—AVIATION, Aug. '45.

Superchargers 2

Mechanical principles, manufacturing processes, and applications of company's product are given in booklet, *Supercharging for Greater Power and Increased Performance,* from B-W Superchargers, Milwaukee.—AVIATION, Aug., '45.

Contact Metals and Alloys.....3

Containing useful tables on physical properties of pure contact metals and alloys, bulletin from Callite Tungsten Corp., Union City, N. J., gives graphs of relation between minimum arcing current and voltage of different materials, relative performance of various alloys, and other data.—AVIATION, Aug., '45.

Bearings Manual 4

New Departure Div., General Motors Corp., Bristol, Conn., offers Booklet BA, titled *Bearing Application,* covering important fundamentals of bearing mounting applicable to all types, pre-loading methods, use of various types, and other information.—AVIATION, Aug., '45.

PRODUCTION

Hose and Couplings.....5

Bulletin No. 600 from Seamlex Co., Long Island City, N. Y., describes "Seamlex" with Type W fittings, welded or brazed type, and illustrates hose with various welded-on couplings.—AVIATION, Aug., '45.

Leather Packings 6

Containing engineering standards, new catalog and text book on leather packings has been issued by Chicago Belting Co., Chicago.—AVIATION, Aug., '45.

Friction Material Catalog.....7

Described in catalog from Raybestos-Manhattan, Passaic, N. J., is complete line of friction materials for industrial equipment.—AVIATION, Aug., '45.

Parts-Cleaning Material.....8

Folder from E. A. Gerlach Co., Philadelphia, describes "70 Stripper," parts cleaning material for stripping metals of baked finishes, lacquers, and of foreign substances. Publication of this literature marks return of product to available list.—AVIATION, Aug., '45.

Machining Practice 9

Practice in Machining Zinc Alloy Die Castings is title of booklet from New Jersey Zinc Co., New York City. Technical data is included.—AVIATION, Aug., '45.

Welding Electrodes 10

Describing characteristics and applications of alloy welding electrodes, and recommending uses and procedures, circular is offered by Welding Equipment & Supply Co., Detroit.—AVIATION, Aug., '45.

Shipping Containers 11

General Box Co., Chicago, offers new issue of *The General Box,* booklet containing suggested uses for various types of containers.—AVIATION, Aug., '45.

Coated Fabrics 12

First installment of series on history and development of coated fabrics is contained in first issue of *The Pantasote,* new house organ of Pantasote Co., New York City.—AVIATION, Aug., '45.

Bellows 13

Brochure from Cook Electric Co., Chicago, contains outline of facilities of company, and describes its line of "Springlife" bellows, pressure detectors, indicators, and other products.—AVIATION, Aug., '45.

Spray Guns 14

B. F. Goodrich Co., Akron, has issued new catalog on Lonn rubber blow and spray guns and water savers. Principle of valves is explained and applications listed.—AVIATION, Aug., '45.

Glue and Pot 15

Circular from Kindt-Collins Co., Cleveland, describes "Master" automatic electric glue pot and flake pattern glue.—AVIATION, Aug., '45.

Aviation Products 16

Products for the Aviation Industry is title of booklet from Johns-Manville, New York City. Detailed are packings, gaskets, and seals; asbestos tubing and textiles for fireproofing; and friction and insulating materials. Also listed are built-up roofs, transite, rock wool insulation, asphalt tile flooring, acoustical materials, ducts, pressure pipe, and sewer pipe.—AVIATION, Aug., '45.

Bronzes 17

Containing photomicrographs, physical-properties data and chemical composition information on "Ampcoloy" alloys, Bulletin 59 is available from Ampco Metal Milwaukee.—AVIATION, Aug., '45.

Non-Extrusion Packing 18

T-ring packing reported to prevent extrusion of sealing material is described in bulletin from Weatherhead Co., Cleveland.—AVIATION, Aug., '45.

Hard Surfacing 19

Proper technique in application of alloys to steel surfaces by welding is described in new edition of *Welders Guide to Successful Hard Facing,* issued by Miro-O-Col Alloy Co., Los Angeles.—AVIATION, Aug., '45.

MACHINERY & ACCESSORIES

Portable Infra-Red 20

Various models of portable infra-red

AVIATION READER'S SERVICE

AUGUST 1945

AVIATION, 330 W. 42nd St., New York City 18

Please send me additional information according to key numbers circled.

INFORMATION TIPS:						1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60						
NEW PRODUCTS:						61	62	63	64	65	66	67	68	69	70	71	72	73
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91
92	93	94	95	96	97	98	99	100	101	102	103	104	105	106			

NAME.....TITLE.....

FIRM OR AFFILIATION.....

ADDRESS.....

equipment, made by Fostoria Pressed Steel Co., Fostoria, Ohio, are described in pamphlet.—AVIATION, Aug., '45.

Granite Surface Plate.....21

Bulletin from Ideal Commutator Dresser Co., Sycamore, Ill., describes new "Ideal" granite surface plate, made of Vermont granite, ground and lapped. Material will not corrode and is non-magnetic.—AVIATION, Aug., '45.

Flash Welding 22

Advantages of flash welding are described in circular from American Welding and Mfg. Co., Warren, Ohio.—AVIATION, Aug., '45.

Temperature Control Cabinets.....23

Cabinets, baths, ovens, and furnaces for use with controlled temperatures are described in Catalog No. 325 being mailed by Precision Scientific Co., Chicago.—AVIATION, Aug., '45.

Aircraft Carburetor Tester.....24

Service Bulletin No. 41, from Holley Carburetor Co., Detroit, contains description of portable instrument for testing manual and automatic mixture controls of company's carburetor.—AVIATION, Aug., '45.

Pumps 25

Bulletins AQB400.1 and AQB500.1, from Fairbanks, Morse & Co., Chicago, describe, respectively, Figure 6920 oil lubricated turbine pump, and Niagara propeller pumps.—AVIATION, Aug., '45.

Offset Back Spotfacer.....26

Engineering data on application of offset back spotfacer made by Edlund Tools, Detroit, is contained in Bulletin BSF445.—AVIATION, Aug., '45.

Abrasive Blasting Machine.....27

Airless "Wheelabrator," using controlled centrifugal force for abrasive blasting, is described in catalog from American Foundry Equipment Co., Mishawaka, Ind.—AVIATION, Aug., '45.

Hob Checker 28

Bulletin No. 464-45, from Michigan Tool Co., Detroit, describes Model 464 "Sine-Line" bench-type hob checker for contours ranging up to 6 in. o.d. and with max. length of 8¼ in.—AVIATION, Aug., '45.

Rotary Pump Catalog.....29

Jameson & Co., Hollywood, Calif., offers new catalog on Harman fuel and oil transfer pumps, engine pre-oiler units, portable high pressure air compressors, preservative sprayer equipment, and desludging units.—AVIATION, Aug., '45.

X-Ray Diffraction in Research.....30

Geiger-Counter Spectrometer for Industrial Research, special study by H. Friedman, of the Naval Research Laboratory, discussing theory of X-ray powder diffraction, and describing working of spectrometer, has been issued in booklet form by North American Phillips Co., New York City.—AVIATION, Aug., '45.

Fine-Dust Collector 31

Co lector designed for collection of fine gri ding and polishing dust is described in bulletin from Leiman Bros., Newark, N. J.—AVIATION, Aug., '45.

Tube End Former 32

No. 7 tube end forming machine, a double action hydraulic press automatically operated, is described in circular from Vaill Engineering Co., Waterbury, Conn.—AVIATION, Aug., '45.

X-Ray Diffraction Apparatus.....33

Picker X-Ray Corp., New York City, has issued new brochure on line of apparatus for X-ray diffraction. Process is profusely illustrated and described.—AVIATION, Aug., '45.

Gear Finishing Cutters.....34

Rotary and rack type gear finishing cutters, laps, burnishers, and master checking gears, are described in Bulletin E-45 issued by Colonial Tool Co., Windsor, Ont.—AVIATION, Aug., '45.

Tapping Machines 35

New features of medium duty tapping machines manufactured by Detroit Tap & Tool Co., Detroit, are described in company's Bulletin MTM-45.—AVIATION, Aug., '45.

Electric-Type Controllers 36

Descriptive material, details of applications, and contact and load circuit wiring diagrams of new "Microact" and other electric-type "Pyromaster" controllers, are contained in folder from Bristol Co., Waterbury, Conn.,—AVIATION, Aug., '45.

Infra-Red Ovens 37

Designed for small shop or use as accessory to spray booth when no conveyor is available, "Tub" oven made by Infra-Red Engineers & Designers, Cleveland, is described in newly issued catalog page.—AVIATION, Aug., '45.

Electrode Catalog 38

Entire line of welding electrodes made by Air Reduction, New York City, is shown in new catalog which contains details of applications and procedures, also specifications.—AVIATION, Aug., '45.

Forging Press 39

Hydraulic forging press, manufactured by Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, is subject of company's Bulletin 4407.—AVIATION, Aug., '45.

Vibration-Fatigue Testing 40

Emphasizing importance of postwar product testing, new folder describes vibration-fatigue testing machines made by All American Tool & Mfg. Co., Chicago.—AVIATION, Aug., '45.

Centerless Thread Generators.....41

Steinle Machine Co., Hartford, Conn., has issued circular giving details of centerless thread generator presently imported from England but soon to be manufactured by company in Hartford.—AVIATION, Aug., '45.

Materials Handling 42

Material Handling News, Vol. 4, No. 2, issued by Clark Tructractor Div., Clark Equipment Co., Battle Creek, Mich., describes pictorially many applications of pallet and fork truck to movement of war materials.—AVIATION, Aug., '45.

ELLSTROM

CHROMIUM PLATED

ROUND GAGE BLOCKS

NOW AVAILABLE

Doubles the Gaging Surface

AVAILABLE in three standard degrees of accuracy—"working sets" with a guaranteed tolerance of plus or minus .000008 inch per inch of gage, "inspection sets" with a guaranteed tolerance of plus or minus .000004 inch per inch of gage and "laboratory sets" with a guaranteed tolerance of plus or minus .000002 inch per inch of gage.

1. When you use the new Ellstrom round gage blocks, practically *all* of the gaging surface can be utilized because there are no corners, as in the case of the rectangular or square blocks. For example, the gaging area of a round block is .9970 square inch while the gaging area of a rectangular block is .4968 square inch. Gage life is thereby increased.

2. Chromium plating increases gage life many times over ordinary steel gage blocks.

3. Use of the round shape gage virtually eliminates chances of tipping, causing possible injury to the gaging surface. "Flats" prevent rolling.

4. Gage quickly returns to room temperature after handling, because of center holes.

ROUND GAGES
PRICES PER SET

Set No. 2-85-W	$464.00
Set No. 2-85-I	695.00
Set No. 2-81-W	437.50
Set No. 2-81-I	656.25
Set No. 2-35-W	222.50
Set No. 2-35-I	318.75
Set No. 2-36-W	259.35
Set No. 2-36-I	373.75

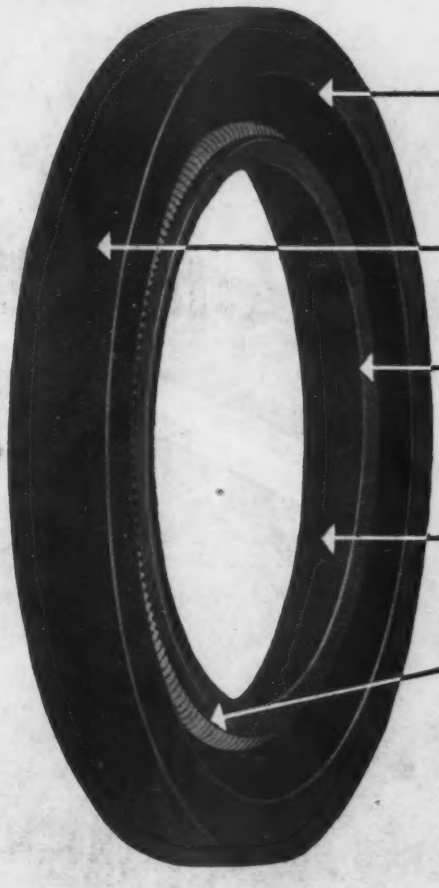
(Prices on individual blocks on request)

DEARBORN GAGE CO. 22035 BEECH STREET DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks

NEW TYPE *non-metallic* OIL SEAL

simplifies design problems... reduces bearing maintenance



One-Piece Precision Molded Body— highly resistant to grease, oil and many corrosive liquids. Entirely non-metallic—can't score.

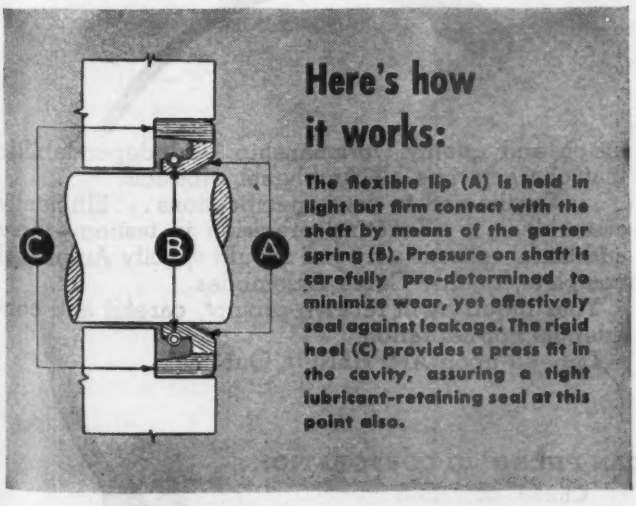
Rigid Heel— made of a dense resin-bonded fabric to insure a press fit in the packing recess.

Flexible Lip— an integral part of the seal. Makes possible accurate control of pressure against shaft by means of self-adjusting garter spring.

Large Bearing Area— reduces wear on shaft to a minimum.

Self-Adjusting Garter Spring— permits accurate control of pressures and provides a positive contact with shaft at all times. Special spring stock is available for extreme corrosive conditions.

THIS new J-M "Clipper Seal" offers distinct advantages both from the standpoint of simplifying design problems and of providing a more effective oil-retaining seal in service.



Here's how it works:

The flexible lip (A) is held in light but firm contact with the shaft by means of the garter spring (B). Pressure on shaft is carefully pre-determined to minimize wear, yet effectively seal against leakage. The rigid heel (C) provides a press fit in the cavity, assuring a tight lubricant-retaining seal at this point also.

Its one-piece, precision-made body, concentrically molded and non-metallic in construction, allows liberal machining tolerances. Its simple, compact shape permits a light flange section that effects compactness of design.

In service, these J-M Clipper Seal features provide a positive lubricant-retaining, dirt-excluding seal . . . automatic in its operation . . . adaptable to a wide range of conditions . . . and highly resistant to most forms of corrosion.

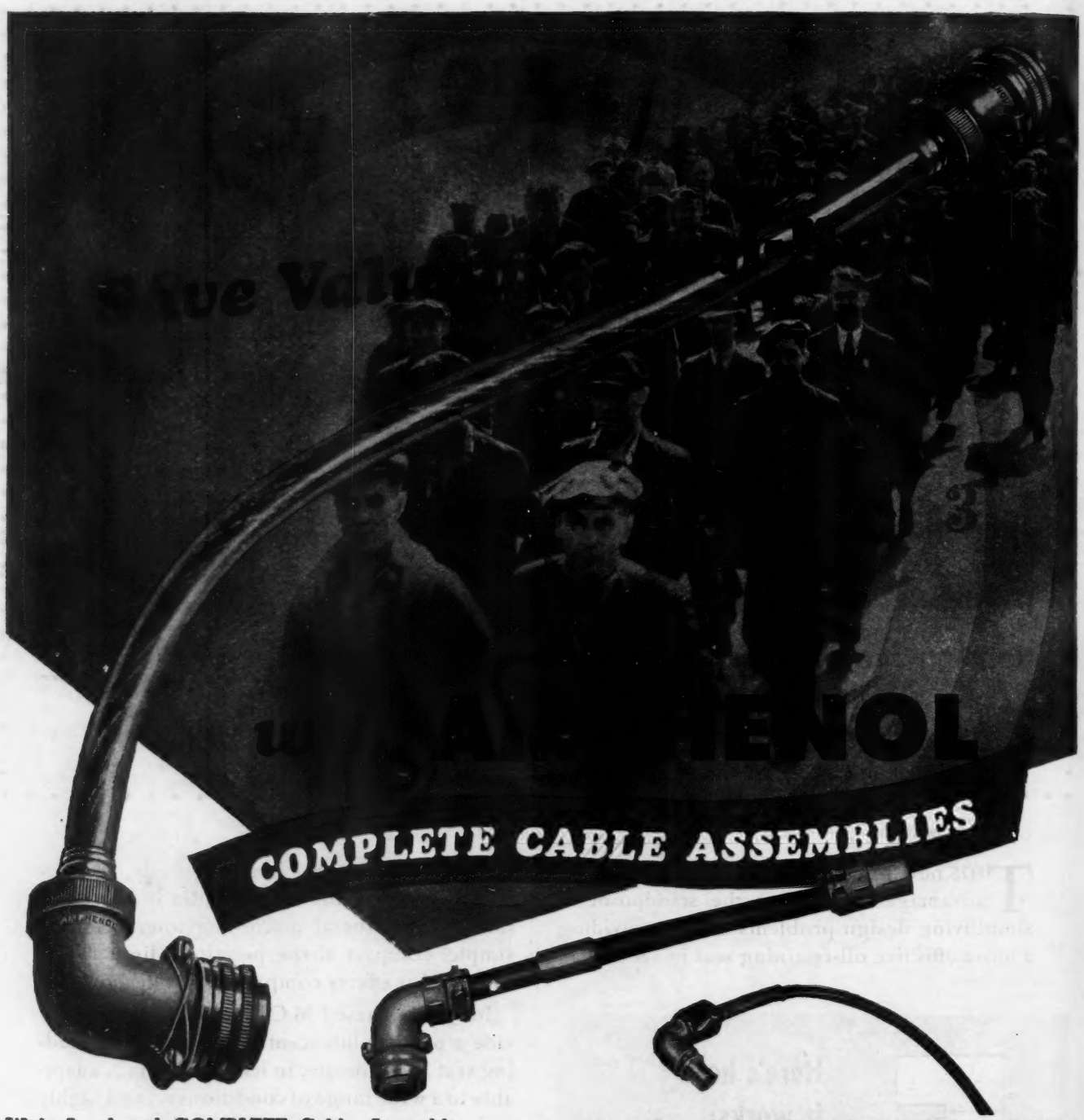
Johns-Manville Clipper Seals are made in sizes for shafts from 1 5/16" to 37" diameter, in both endless and split types. Special designs are available where unusual temperature, pressure or other service conditions require. For further details, write Johns-Manville, 22 East 40th Street, New York 16, N.Y.

J-M PRODUCTS FOR THE AVIATION INDUSTRY

Packings and Gaskets • Friction Materials
Insulations • Asbestos Textiles • Transite Conduit
Transite Pipe • Industrial Building Materials

Johns-Manville

87 YEARS OF SERVICE TO TRANSPORTATION



With Amphenol COMPLETE Cable Assemblies you have only one source of supply . . . issue only one purchase order . . . cut your procuremen cost . . . reduce your labor and tool cost . . . eliminate production and assembly worries . . . all of these add up to a substantial savings in valuable man-hours and manufacturing cost.

Tremendous volume production has necessitated the creation of countless jigs, fixtures and special equipment with resultant lower assembly cost, precision and quality workmanship, and dependability that characterizes all Amphenol products.

. . . Engineered to your specifications . . . Efficiently assembled . . . Exacting precision in testing—three additional reasons why you should specify Amphenol complete, quality Cable Assemblies.

Your inquiry will receive prompt, careful and confidential consideration.

Depend upon AMPHENOL Quality.

Depend upon AMPHENOL Quality

AMERICAN PHENOLIC CORPORATION
Chicago 50, Illinois
In Canada • Amphenol Limited • Toronto

U.H.F. Cables and Connectors • Conduit • Fittings • Connectors (A-N, U.H.F., British) • Cable Assemblies • Radio Parts • Plastics for Industry

Welding Rods and Electrodes.....43

Index of new digest booklet from Page Steel & Wire Div., American Chain & Cable Co., Monessen, Pa., features listings according to type and class of material to be welded, thus enabling easy selection of proper electrode or gas welding rod for specific job. Digest is numbered DH-821.—AVIATION, Aug., '45.

Flexible Shaft Machines.....44

Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn., announces publication of comprehensive catalog covering line of "Kellerflex" flexible shaft machines and accessories.—AVIATION, Aug., '45.

Cutting Tools 45

Circular from Continental Tool Works, Detroit, Mich., lists line of metal cutting tools and describes Type "R" face milling cutters.—AVIATION, Aug., '45.

ELECTRICAL

Wire Bound Resistors.....46

Simplification of selection of fixed wire bound resistors is feature of engineering Bulletin R, issued by Shallcross Mfg. Co., Collingdale, Pa.—AVIATION, Aug., '45.

Generators 47

Description and pertinent dimensions of line of a.c. and d.c. generators, motor generator sets, and d.c. motors, are contained in new catalog from Kurz & Root Co., Appleton, Wis.—AVIATION, Aug., '45.

Relays 48

Guardian Electric & Mfg. Co., Chicago, has issued new catalog containing 56 pages of descriptive matter on line of relays, thermostats, and other electrical instruments.—AVIATION, Aug., '45.

Resistors 49

New resistor catalog from Ward Leonard Electric Co., Mt. Vernon, N. Y., describes various types and gives sizes, resistance values, and data on mountings and enclosures.—AVIATION, Aug., '45.

Capacitor Nomograph 50

Sprague Electric Co., North Adams, Mass., offers without charge a pulse service capacitor nomograph (designated as Technical Bulletin No. 11) designed for determining voltamperes through a capacitor used in rectangular pulse service.—AVIATION, Aug., '45.

STEELS

Seamless Tubing 51

Information is available from Michigan Seamless Tube Co., South Lyon, Mich., on seamless steel alloy aircraft tubing and other types, also information on dimensions and weights of pipe sizes.—AVIATION, Aug., '45.

Steel Welding Rod 52

American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill., has issued Bulletin 345-W on Amsco "Toolface". Product is steel welding rod for hard surfacing operations and for making, salvaging, and altering cutting tools.—AVIATION, Aug., '45.

Cutting Alloy 53

Analysis and applications of "T & V" cutting alloy is contained in folder from Jessop Steel Co., Washington, Pa.—AVIATION, Aug., '45.

PLASTICS AND SYNTHETICS

Cowl Mountings 54

Bulletin No. BU-34, from Bushings, Inc., Berkley, Mich., describes characteristics of new synthetic-insulated aircraft cowl mountings described as impervious to oil and as having high rate of vibration and shock absorption.—AVIATION, Aug., '45.

Transparent Tote Boxes 55

New Plastics Bulletin No. 27 (Vol. 8), issued by E. I. Du Pont de Nemours Co., Arlington, N. J., contains special article on transparent tote boxes used for instrument parts.—AVIATION, Aug., '45.

Material Handling News
CLARK
24 PAGES pictorially presented, showing CLARK Fork Trucks and pallet methods in 32 different types of materials handling operations.
Contains illustrations and specifications of different pallet designs.
Yours for the asking—mail the coupon NOW!
CLARK EQUIPMENT COMPANY
CLARK TRUCTRACTOR DIVISION
1002 JAMES STREET, BATTLE CREEK, MICHIGAN
I would like a copy of your book "CLARK BOOK ON PALLETS"
Name.....
Company.....
Address.....
City.....Zone....State.....

Scott

GASOLINE GAUGES

GEAR TYPE DIAL GAUGE MODEL A21

GEAR TYPE WITH DRUM GAUGE MODEL A21-9

SPIRAL TYPE DIAL GAUGE MODEL A22

Economical—
Reliable—

A TYPE FOR EVERY TANK

Manufacturers of light airplanes will be interested in the many advantages to be gained from *standardizing* on Scott Direct Reading Gasoline Gauges. Extremely moderate in cost, they are accurate, dependable, completely fool-proof. Cast aluminum head and hard brass working parts. Shielded magnetic transmission assures positive vapor and moisture-proof seal. Impregnated cork float for life-long service. Vibration-proof. Service-tested. A type for every style tank and installation. Clear-face dials. Readings in black on white—white on black or radium. It will pay you to investigate today.

SPECIFY AS

"Standard"

Scott

AVIATION CORPORATION

ESTABLISHED 1932

214 ERIE ST. LANCASTER, N. Y. U. S. A.

PARTS AND INSTRUMENTS

Avigation 56

Pamphlet descriptive of new Jardur-Warner avigational plotter has been issued by Jardur Aviation Co., New York City.—AVIATION, Aug., '45.

Compass 57

Brochure on its new Gyrosyn compass has been issued by Sperry Gyroscope Co., Div., Sperry Co., Brooklyn, N. Y. Instrument combines functions of directional gyro and magnetic compass.—AVIATION, Aug., '45.

PLANT MATERIALS

Factory Flooring 58

Master Builders Co., Cleveland, has issued booklet descriptive of "Masterplate", metallic-concrete flooring material designed for new floors and for resurfacing old floors. Iron particles, cement-welded, are components.—AVIATION, Aug., '45.

Floor Cleaner 59

"Maintenex", cleaning material for floors reported to be free from abrasives and fillers, is described in circular from A. C. Horn Co., Long Island City, N. Y.—AVIATION, Aug., '45.

INSTRUCTION

Precision Measurement 60

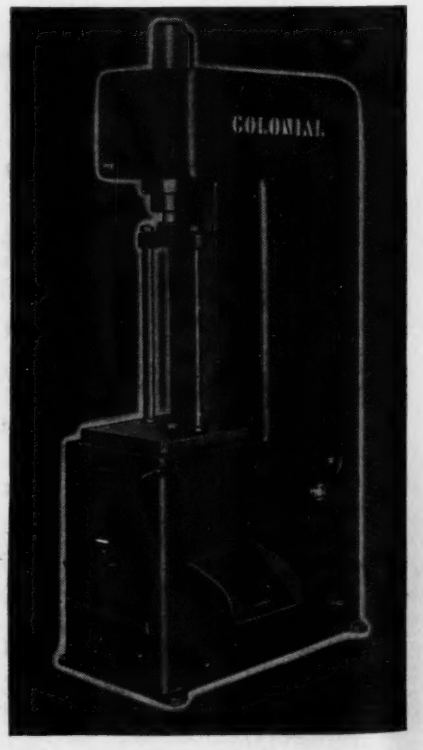
Science of Measurement is title of new correspondence course on precision measurement offered by Continental Machines, Minneapolis. Course includes individual booklets on various phases of measurement. Information on distribution of course is available from company.—AVIATION, Aug., '45.

NEW PRODUCTS

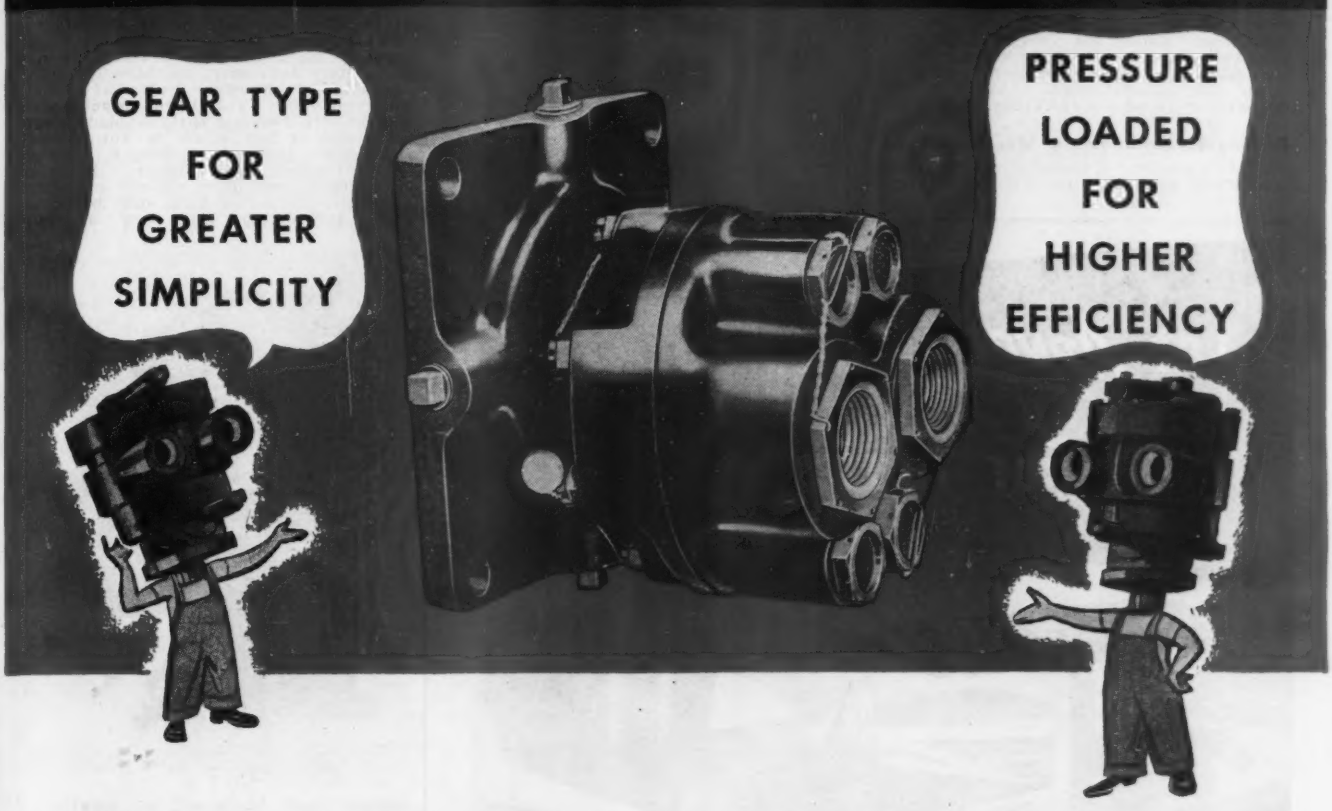
Latest Machinery

Pull-Broaching Attachment 61

New attachment for broaching presses made by **Colonial Broach Co.**, Detroit, enables pull-broaching as well as push-broaching. Attachment has two vertical



Pesco ENGINE DRIVEN HYDRAULIC PUMPS



● Outstanding performance. Dependability beyond the ordinary. That's the record of PESCO Engine Driven Hydraulic Pumps in modern aircraft.

PESCO designed these pumps especially to meet the exacting needs of aircraft hydraulic systems. For greatest simplicity there's improved gear type construction that reduces working parts to a minimum. That means greater dependability, longer life, less service and maintenance.

And through *Pressure Loading*, an exclusive PESCO development, high efficiency is maintained through a wider range of operating conditions. PESCO *Pressure Loading* compensates for wear and thermal variations encountered in high altitude flight to maintain minimum end clearance between pump gears and gear housing.

Models are available with pressure limits up to 3000 p.s.i. Capacities up to 12 g.p.m. Weights from 2.5 to 10 lbs.

New descriptive literature is now available. Write for Engine Driven Hydraulic Pump folders to PESCO Products Co., (division Borg-Warner), 11610 Euclid Avenue, Cleveland 6, Ohio.

PESCO advanced design and performance extend through a complete line of air, vacuum, fuel and hydraulic pumps . . . precision equipment meeting practically all aircraft needs for controlled liquid flow and Pressurized Power.

In Aircraft Hydraulics, Fuel Pumps, Air Pumps, Related Accessories . . .
PERFORMANCE POINTS TO Pesco FIRST

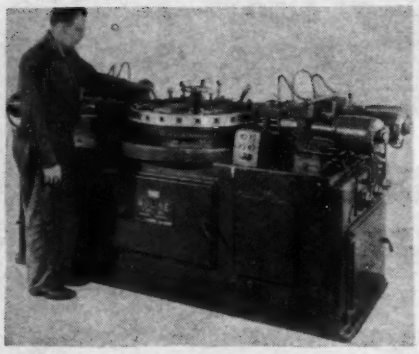
guide rods, tied together top and bottom. Lower tie-bar carries puller adapter to permit use of automatic pullers. Guides slide in long bushings pressed into platen bed. Attachment is available on full line of presses.—**AVIATION, Aug., '45.**

Pneumatic Die Grinder.....62

Special features of new 25,000 rpm. pneumatic die grinder made by **Keller Tool Co.**, Grand Haven, Mich., include built in oil reservoir from which oil for 8 hr. operation is metered; aircooled cylinder; and bearings rigidly mounted in end plates and lubricated for 1,000 hr. operation. Models are available equipped with collet chuck, with adapter for holding unmounted grinding wheels, and with ¼ in. cap. Jacobs chuck. Length is 6¾ in., weight 18 oz.—**AVIATION, Aug., '45.**

Drilling-Boring-Reaming Machine....63

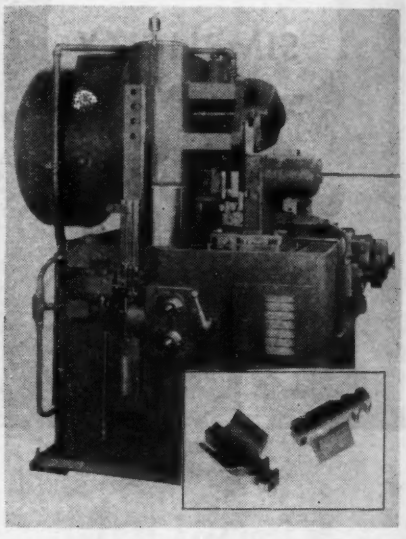
Special automatic machine designed for machining aircraft gun turret ring has



applications to other types of metal parts, states maker, **Moline Tool Co., Moline, Ill.** Model M32 (photo) automatically drills and reams 24 groups of 4 small holes, and at same time finish bores and chamfers a larger hole located at center of each group. There are two 4-spindle drilling units, two 4-spindle reaming units, and two single-spindle precision boring units. Each unit has its own hydraulic feed cylinder and feed rate regulating valve. Complete automatic control is electric and work is indexed hydraulically.—**AVIATION, Aug., '45.**

Bar Stock Miller.....64

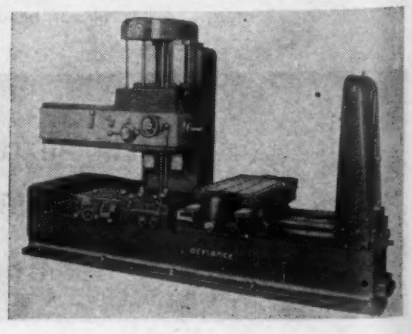
Described as suitable for manufacture of hinge parts, pole pieces, turbine blades, molding, hardware, and other parts, new, completely automatic machine for milling and cutting off parts from bar stock is announced by **Kent-Owens Machine Co.**, Toledo. In making turbine blades, crescent shaped bar stock is automatically fed against end stop by torque motor and then clamped hydraulically. Head has three cutter spindles. Form cutters on two lower spindles form mill blade (see inset in photo), and saw on upper

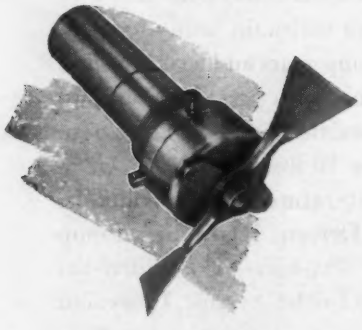


spindle cuts blade off to length. As head returns to upper position, stock is unclamped, advanced into position by motor for new part, and again clamped. Attention of operator is not required. Any desired cycle or feed rate may be obtained through adjustments. Fixture and clamping jaws to accommodate various cross section shapes of stock can be provided. Head can be furnished with single spindle for simple cutting-off operations, or with number of spindles for both milling and cutting off.—**AVIATION, Aug. '45.**

Combination Mill 65

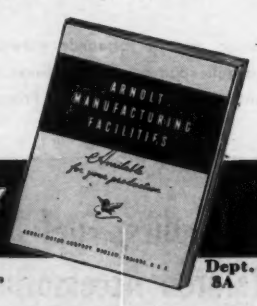
Designed for production, but especially suited to small jig and die work, new 2½-in. horizontal boring, drilling, milling, and tapping machine has been developed by **Defiance Machine Works,** Defiance, Ohio. Speeds from 25 to 1,600 rpm. in either direction on main spindle are obtainable. It has direct reading indicator for spindle speeds, and feed chart. Brake stops spindle. Machine has 18 feeds in geometrical progression, ranging from .002 to .125 per revolution of spindle, and 5 feeds are standard tapping leads. Column ways are 5 x 1½ in. and 18 in. across. Bed ways are 5 x 1½ in. and 24 in. across. Table has working surface of its entire working area, with "T" slots and





Important parts of the *M-103 nose bomb fuse*, that controls the timing of the explosion of general purpose, demolition, and S. A. P. bombs, are made in Arnolt plants.

There may be several parts of your product which could be produced for you faster and at lower cost in Arnolt plants. Arnolt's experience in sub-contracting for leading manufacturers in automotive, aviation and boating industries is your assurance of sound engineering and precision workmanship. For complete details on Arnolt manufacturing facilities, mail the coupon below today.



ARNOLT MOTOR COMPANY
WARSAW, INDIANA

Please send your new 16-page illustrated brochure, "Manufacturing Facilities Available for Your Production." Dept. 8A

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....

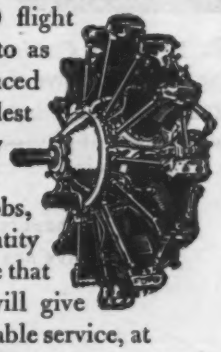
Navigators find the way. Pilots take them there. Bombardiers do the big damage... But it's the boys in the back room who bring the bombers back—the gunners.

Huddled in flying suits, masked and goggled, they stand by on the high cold course, helpless against the buffeting or fiery shell particles of flak, eyes probing the somber metal skies for the dots that mean danger. As the fighter pack closes within range, they loose their twin stingers on anything that flicks by their sights ... fire in solo, series or chorus, keep enemy ships respectful, fight off interference attacks, chalk up individual kills like fighter pilots.

THE gunners run young, fresh from the farm, factory, high school. They rate perfect in eyesight, are quick on the gun trigger, long on guts and loyalty, wear chevrons and rockers, and more decorations than any other enlisted men in any other army. They fly, fight, live and play as crews; but they die alone. They get to know sudden death, ugly wounds, wakeful nights in dark barracks by the empty bunks of missing friends...These are today's heirs of the American tradition, and they do their forebears and their country proud!

IT was our privilege to make more than 20,000 Jacobs engines, and more than 10,000 of another make, for the twin-engine planes which schooled the bomber crews.

And it is our pride that the Jacobs engines served well both student airmen and American taxpayers... raised their service periods between major overhauls from the 350 flight hours originally specified up to as much as 1,200 hours...and reduced maintenance costs—in the hardest kind of service required of any plane engines.

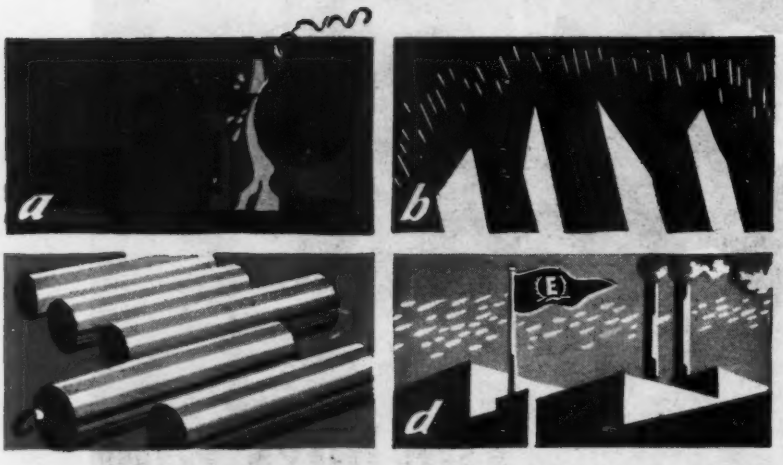


The service records of the Jacobs, the experience acquired in quantity production, are the best evidence that Jacobs new postwar engines, will give even longer trouble-free, dependable service, at low costs!... Jacobs Aircraft Engine Company, A Division of Republic Industries, Inc.

JACOBS • **Pottstown, Pa.**

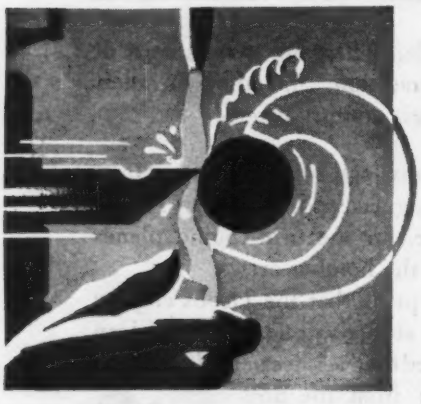
A Division of Republic Industries, Inc.

MACHINISTS RELY ON RED LINE FOR THE RIGHT CUTTING OIL



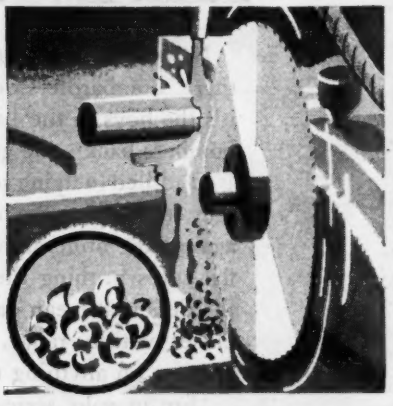
1. Skilled machinists make sure they have the correct cutting fluid for each job. It means faster cutting speeds, longer tool life, better surface finishes and increased production.

2. And machinists rely on Red Line for the right cutting oils. That's because each fluid is developed from a formula based upon extensive research and practical experience in the industry.



3. Red Line Cutting Fluids keep the tool cool, have the right chemical affinity for the metals worked, help prevent thermal distortion which causes inaccurate dimensions.

4. They have the stability and the proper lubricating qualities to reduce power consumption, excessive wear, and heat generation. And they protect against corrosion.



5. Red Line Cutting Fluids also assist satisfactory chip formation and wash away the cuttings (particularly desirable in hack sawing, milling, grinding, and deep hole drilling).

Join the hundreds of shops that regularly rely on Red Line for the right cutting fluids. Your local Union Oil representative has a supply, or if a special problem develops write Union Oil Company, Los Angeles 14, California.

Red Line Cutting Fluids

UNION 76

Another **UNION OIL** *Success-Tested Product*

cross slots. Backrest with boring bar support has one Vee and one flat way. Saddle is guided on inside of bed ways. Spindle head unit has substantial bearing on column, and it is counter-balanced. Actuating screw is located in center of column ways between dovetail guiding edge and tapered take-up gib on inside of column ways.—AVIATION, Aug., '45.

Vertical Broaching Machine.....66

New vertical broaching machine developed by **Zagar Tool Co.**, Cleveland, is built with three guide bars, similar to 3-post die shoe, by means of which broach is pushed straight without deflection in machine column. Broach is pushed with cone-shaped cup located in top adapter

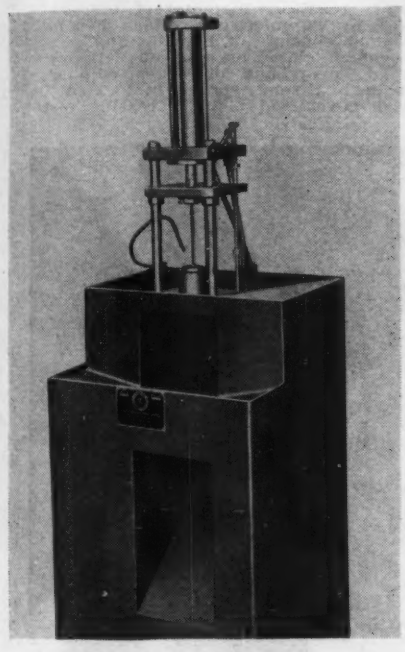
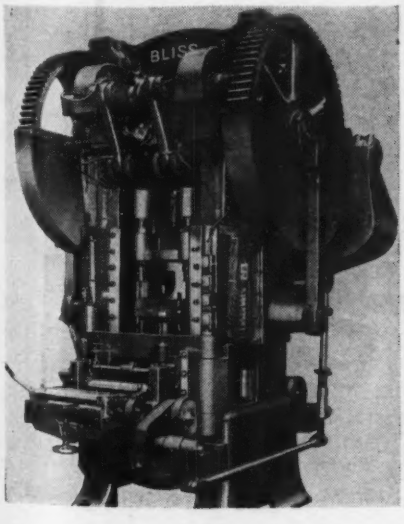


plate and which mates up with 45 deg. angle ground onto pushing head of broach. No holders or attachments are used. Broach is pushed through and returned. Dimensions: Height, 72 in.; depth, 25 in.; width, 25 in. Motor is 1 hp. There are two speeds. Pressure is 1 ton at 25 fpm. —AVIATION, Aug., '45.

Automatic Toggle Press.....67

Feature of automatic toggle press No. 3½B, manufactured by **E. W. Bliss Co.**, Brooklyn, is that automatic operation is provided to handle the coil brass or steel, blankholder serving dual purpose of blanking disks from coil strip and holding blank for drawing operation. Coil stock is fed through a 7-roll straightener (to remove curvature), a precision double roll feed, and a shear type scrap cutter. An automatic stock oiler is attached to feed. Scrap cutter is furnished with spring



Flying High!

AIRCRAFT ENGINES KEPT PURRING WITH *CLEAN* OIL

To keep fighters and bombers flying from far-flung bases the world over, the lubricating oil for aircraft engines is kept clean by frequent filtering with portable units powered by gasoline engines. One more of many standard and special applications for Briggs & Stratton 4-cycle *air-cooled* gasoline engines.

Everywhere they continue to establish new performance records—adding to their reputation as the world's finest small air-cooled engines—forcasting greater utility than ever before on a steadily increasing number of gasoline-powered appliances and equipment.

Air-Cooled Power

4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES

Briggs & Stratton leadership in design, engineering and precision manufacture is the result of a quarter-century of *continuous* production of *"air-cooled power."* Manufacturers and users of all types of equipment requiring dependable, compact gasoline powered units will find it profitable to call for this experience to help them solve their power problems.

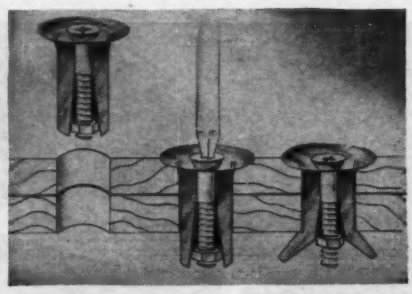
BRIGGS & STRATTON CORPORATION, Milwaukee 1, Wis., U.S.A.

hold-down and four edged tool-steel blades. Incoming feed rolls and straightening unit are mounted on vertical pivot. Feed and scrap cutter are driven by elliptical gears. Twin driving gears are employed on crankshaft and blankholder has twin drive. Double gearing is provided, also friction clutch with electric push button control. Air brake stops flywheel.—**AVIATION, Aug., '45.**

Shop Equipment & Materials

Blind Bolt Assembly.....68

Illustrated is "Des-Bolt," new plastic fastener manufactured by **Victory Mfg. Co.**, So. Pasadena, Calif. Unit comprises



molded plastic expansion sleeve and any standard bolt and nut assembly of a size to match sleeve. Sleeve is composed of three slim fingers with inside taper extending approx. three-fourths of their length from flanged head. Head is flange with cored hole to accommodate bolt shank and countersunk to receive standard countersink type bolts, with three sharp ribs attached to flange and sleeve. These ribs wedge into work and prevent turning of sleeve. To apply, assembled unit is inserted into drilled hole, unit tapped lightly with screw driver, and bolt tightened. Inside tapered surface of prongs restrains nut from turning. As bolt is turned, nut is drawn into prongs and forces them outward, also drawing work together. Standard sizes currently offered range from ¼ to ¾ in. dia. by ¼ to 3 in. in length, but special sizes may be ordered.—**AVIATION, Aug., '45.**

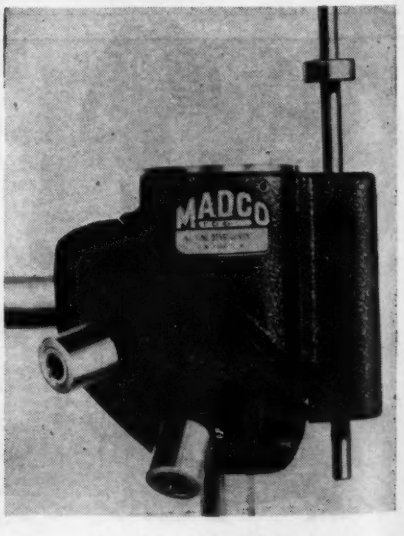
Portable Hardness Tester.....69

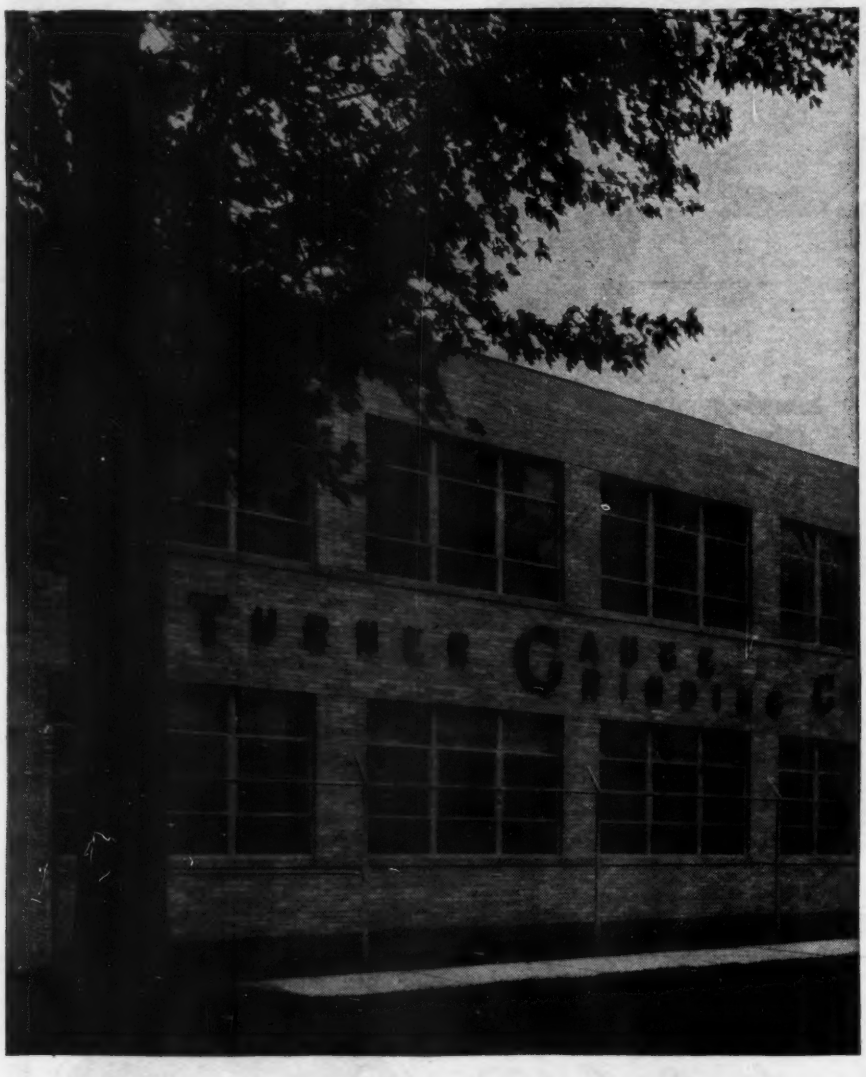
In instances where it is sufficient to know the hardness of a surface with respect to workability only, portable self-acting hardness testing hammer Type P, manufactured by **Steel City Testing Laboratory**, Detroit, is reported to give satisfactory results. Diameter of impression made by hammer determines hardness. Hammer consists of housing and piston. Housing is closed on one end with inside thread cover, and on other with open bushing. Strong spring is located between cover and piston, pressing piston

against bushing. Adjustment of spring tension governs power of stroke. Piston is coupled with a striking piston which projects through bore of bushing, guided by airtight fitting ring in cylinder and carrying steel ball on end. With ball end against material, pressure on operating end then actuates tool.—**AVIATION, Aug., '45.**

Turret Drill Head.....70

Featuring new type indexing depth stop designed to control drilling depth of six spindles of turret head, Model No. 275 drill head, made by **Madco Products Co.**, New York City, has completely enclosed stop mechanism which comprises cylindrical drum carrying six adjustable stops which can be positioned through opening in housing. Drum is geared to head and





FIVE BROTHERS founded the Turner Gauge Grinding Company at Ferndale, Michigan, and proceeded to develop an organization of skilled workers backed by the best precision equipment obtainable. Buildings are modern, well ventilated and clean. Superior working conditions generate a superior product. Made here are Cylindrical Plug Gauges, Plast-O-Lock Plug Gauges, Cylindrical Ring Gauges, Special Flush Pin Gauges, Solid Type Snap Gauges, Master Discs and Built-up Gauges.

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY

2625 HILTON ROAD • • FERNDALE 20 MICHIGAN

Aeroprops—for the busy pace of peace

Proved in War, this General Motors Propeller will Serve the Skyways of Tomorrow

WAR still demands the research, engineering, and production facilities of America's aircraft industries. But with final victory drawing nearer, the world of postwar aviation emerges into view.

Super-transports will arch the miles that separate the cities of the nation, the hemisphere, the world. Planes more luxurious and swift than we have ever known will rise from a multitude of new airports.

An important factor in this future is the new General Motors propeller known as the Aeroprop. The lightness, strength and simplicity that have meant so much in war performance will also be available for modern, peacetime flying. The Aeroprop's ease and economy of maintenance . . . its automatic, constant speed operation . . . its simple unit construction . . . its ribbed-steel hollow blades . . . these and other Aeroproducts engineering advancements will play their part in flying's busy future.

For aviation, when it turns to peace, can be expected to use the products that have proved their worth in war.

Aeroprop Advantages—*Lightness* for payload . . . *Strength* for safety . . . *Simplicity* for easy service . . . *Faster Automatic Pitch Change* for flight efficiency . . . *Full Feathering* for engine protection . . . *Engineered* for reliability.

Aeroprop

LIGHT • STRONG • RELIABLE

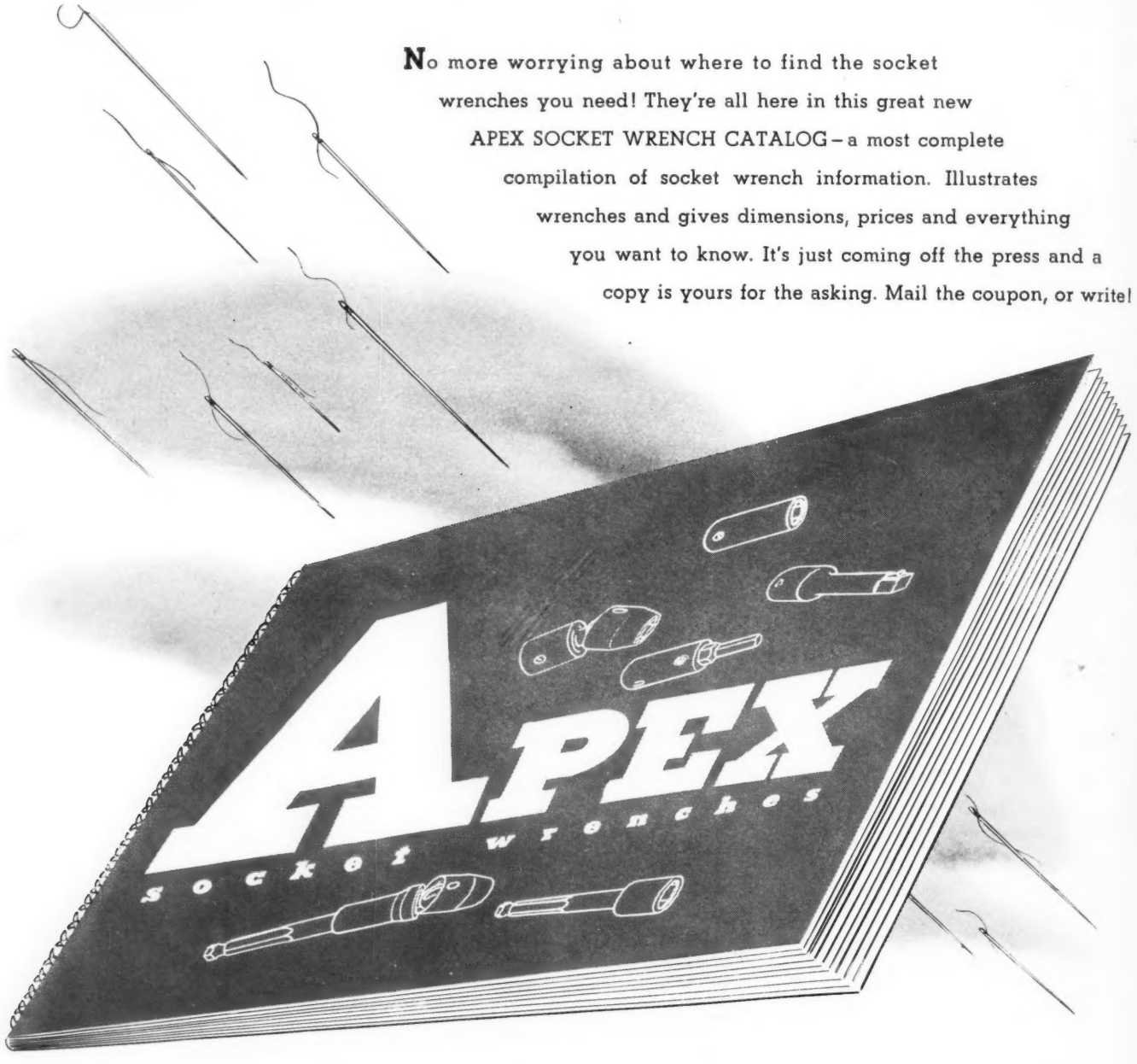
AEROPRODUCTS DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

Keep them flying—Buy Another War Bond!

Like Needles in Haystacks?

Not when you have this New Book!

No more worrying about where to find the socket wrenches you need! They're all here in this great new APEX SOCKET WRENCH CATALOG – a most complete compilation of socket wrench information. Illustrates wrenches and gives dimensions, prices and everything you want to know. It's just coming off the press and a copy is yours for the asking. Mail the coupon, or write!



Send for your Free copy today!

APEX MACHINE & TOOL COMPANY
Dayton 2, Ohio

A-8

Please send us your new, complete socket wrench catalog.

Name_____

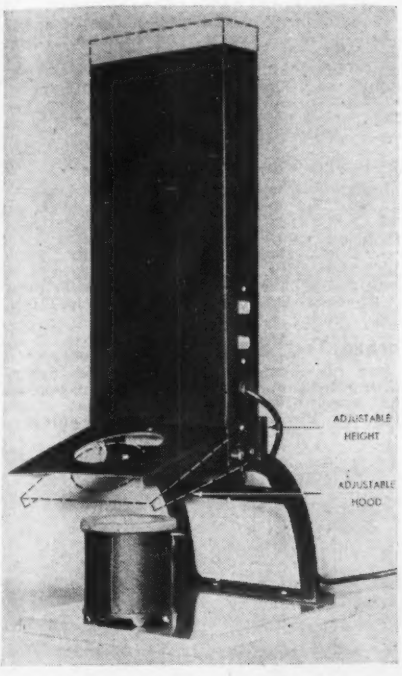
Firm_____ Title_____

Street_____ City and State_____

automatically indexes when the head is turned. Maker states that No. 1 Morse taper precision ground spindles eliminate necessity of chucks and make possible greater interchangeability of tools.—AVIATION, Aug., '45.

Soldering Stand 71

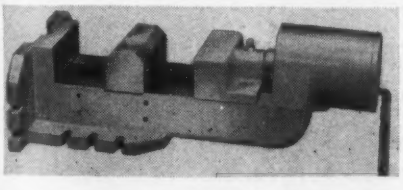
Hood and fume stack of Model SS11 soldering stand, manufactured by Ess Specialty Corp., Bergenfield, N. J., are



adjustable to permit use of iron, torch, or soldering pot. Hood provides protection, and plate glass or magnifying window helps operator focus on work.—AVIATION, Aug., '45.

Air Vise 72

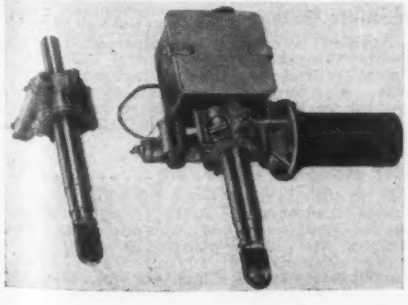
Developed specifically for holding practically any irregularly shaped part within its dimensions, new air vise manufactured by Lombard Machine Co., Los Angeles,



is stated to be particularly adaptable for production runs of large castings or forgings, also for gang milling of numerous small parts.—AVIATION, Aug., '45.

Dual Linear Actuators 73

Foote Bros. Gear & Machine Corp., Chicago, announces two linear actuators with which dual operation is possible. Primary actuator is powered by a 1/6 hp. electric motor. Secondary actuator (motorless) gains its power from the primary through a flexible shaft coupling which synchronizes the two units. Both actuators have linear action of 5 in. at an extension speed of 12 sec. and a retraction speed of 9 sec. Travel of screw



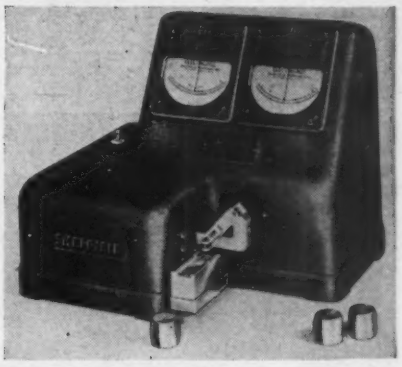
jack is controlled by limit switches and stops may be adjusted by single screw. Devices are stated to be capable of handling working loads up to 750 lb. with static load cap. of 2,500 lb. Primary unit motor operates at 8,000 rpm. from 26v. d.c. at 11½ amp. and is equipped with magnetic brake. Motorized actuator is 13 in. long, 11 in. high, and 4 13/16 in. wide. Weight is 7 lb. 1 oz. Shaft driven model is 10 11/16 in. long, 3½ in. high, and 3¾ in. wide. Weight is 2 lb. 12 oz.—AVIATION, Aug., '45.

Welding of Jet Engines.....74

Producing weld metal that withstands great temperatures and stresses encountered in jet propulsion engines, new electrode is announced by Arcos Corp., Philadelphia. Chemistry and physical properties are not divulged due to restrictions.—AVIATION, Aug., '45.

Bearing Contour Comparator.....75

Sheffield Corp., Dayton, Ohio, announces bearing contour comparator with "Electrigage" heads, designed to check barrel-shaped bearing rollers for contour only. Bearing slides into gaging position on



Reconnaissance Flyers Wear RAY-BANS....
Plotting the course of their mapping flight over Japanese-held islands, these marine aerial photographers wear sun glasses to protect their eyes against burning Pacific sunlight. Letters from hundreds of such flyers tell the men and women of Bausch & Lomb how vital Ray-Ban Sun Glasses are to their flying safety. In use on every fighting front today, genuine Ray-Ban lenses and frames scientifically shut out glare-producing rays, yield sharp, clear, comfortable vision in brightest sun. Bausch & Lomb Optical Co., Rochester 2, New York.
All Ray-Ban Sun Glass production is allocated to military use.
BAUSCH & LOMB
ESTABLISHED 1853
Ray-Bans
IN WAR SERVICE
OFFICIAL U. S. MARINE CORPS PHOTO
BAUSCH & LOMB IS DESIGNER AND PRODUCER OF BINOCULARS, SPOTTING SCOPES, RAY-BAN SUN GLASSES AND A COMPLETE LINE OF OPTICAL INSTRUMENTS

A time saver that speeds production

SCOTCH *Masking* **TAPE**
BRAND
can be die cut to solve difficult masking jobs

"SCOTCH" Masking Tapes with correct weight backings permit dieing out shapes to mask openings, as illustrated.

This is just one of the many jobs where "SCOTCH" Masking Tapes are an outstanding tool for solving production problems that have been "toughies".

"SCOTCH" Masking Tapes are made with a range of constructions such as varied backings — crepe, flatback, lightweight or heavy and correct adhesives. You can select the proper tape to meet specific requirements.

The unmatched experience gained as originator and largest manufacturer of unified pressure sensitive tapes is at your service to help solve your tape problems. Please mail the coupon below... it will bring this help to you—without obligation.

"SCOTCH" is the trade-mark for the adhesive tapes made by M. M. & M. CO.

3-M
MINNESOTA MINING AND MANUFACTURING CO.
GENERAL OFFICES: SAINT PAUL 6, MINN.
BRANCHES IN PRINCIPAL CITIES

A845T

Kindly have a "SCOTCH" Tape engineer call.

Company _____

Address _____

City _____ Zone ___ State _____

By _____ Title _____

"SCOTCH" Tapes are used for
REINFORCING • MASKING
HOLDING • IDENTIFYING
PROTECTING • SPLICING
SEALING • SANDBLASTING

two rails, coming to rest against fixed center arm and lower roller backstop. Upper roller is spring loaded to exert enough pressure on bearing to keep it in gaging position while rotating. Upper and lower arms at left do gaging, while middle arm is fixed for positioning bearing roller. Gaging fingers move reed mechanisms which in turn actuate heads. Middle arm is adjustable. All arms have tungsten carbide inserts.—**AVIATION, Aug., '45.**

Metal-Alloy Sprayer 76

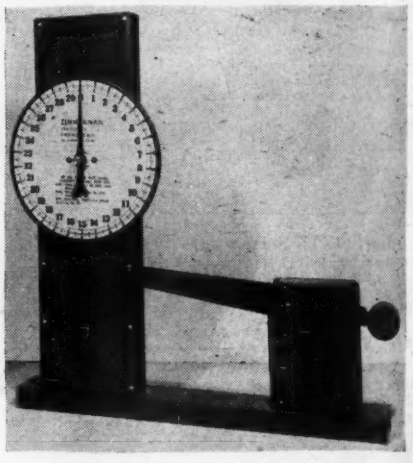
Close control of characteristics of spray is stated to be feature of new metal and alloy sprayer produced by **Alloy-Sprayer Co.**, Ann Arbor, Mich. In Model FP, needle valve controls fineness of spray, and a thumb-operated control makes changes to fine spray, coarse spray, and pour.—**AVIATION, Aug., '45.**

Recording Densitometer 77

Utilized in any field where variations in subject can be detected by electronics, and particularly for detecting variations in photographic or radiographic film, new recording densitometer automatically computes true, logarithmic graph of its findings in 30 sec., states maker, **Triplett & Barton**, Burbank, Calif.—**AVIATION, Aug., '45.**

Torque Test Stand.....78

For checking torque tools and determining torque required for various screws and assemblies, new torque test stand made by **Zimmerman Products Engineering Co.**, North Newington, Conn., consists of standard spring scale with suitable leverage to indicate inch-pound torque. Capacity is 0 to 600 in.-lb. Stand is provided with ½ in. square drive and screw driver slots.—**AVIATION, Aug., '45.**



Rubber Base Paint.....79

Described as an improvement on prewar rubber base paints, "Rubbermastic" paint, made by **Guaranteed Products**, Los Angeles, can be applied, states maker, to walls, roofs, or floors of concrete, brick, stucco, paper, wood, or metal, whether wet, damp, or dry, painted or unpainted, without etching or preparation.—**AVIATION, Aug., '45.**

Non-Spatter Welding Film.....80

Welding spatter is minimized and cleaning time reduced, it is stated, through use of new non-spatter film developed by **Lincoln Electric Co.**, Cleveland. Material is applied with brush or air gun to areas adjacent to joint to be welded, and to jigs, and it can be removed by wiping or brushing.—**AVIATION, Aug., '45.**

Protects Galvanizing 81

Applied by simple dipping at normal room temperatures, "Iridite Galvon", manufactured by **Rheem Research Products**, Baltimore, is reported to offer greater resistance to white corrosion for galvanized products.—**AVIATION, Aug., '45.**

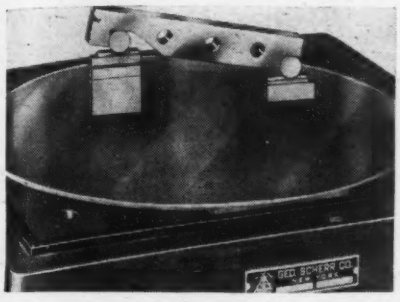
Dies Made on Miller.....82

Hydraulic attachment for milling machines and boring mills is reported to enable production of forming and die-casting dies, and plastic or permanent molds with irregular contours. Maker, **Turchan Follower Machine Co.**, Detroit,

states that with this attachment any desired shape can be produced from soft models of plaster or wood. Control is three-dimensional, one in vertical and two in horizontal plane.—AVIATION, Aug., '45.

Sine Bars 83

Used for determining and measuring angles, four models of sine bars are announced by **George Scherr Co.**, New York City, in sizes 1 x ⅝ x 5 in. and



1 x 1¼ x 5 in. Both models are available in ground-only and lapped surfaces. Illustration shows sine bar appearing on "Opti-Flat", new Pyrex brand glass surface plate.—AVIATION, Aug., '45.

Liquid Belt Dressing 84

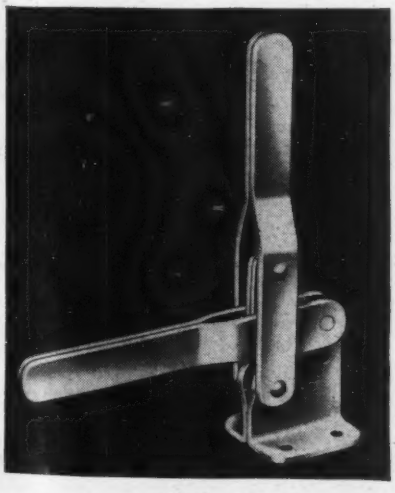
Described as producing an immediate power capacity rise and also great improvement in transmission above rating, new liquid belt dressing has been developed by **Graton & Knight,** Worcester, Mass. Data on results of comparative tests are available.—AVIATION, Aug., '45.

Tape Printing Service.....85

Stating it specializes in quick service, **Topflight Tool Co.**, Towson, Me., is now printing identification tape with new codes, using cellulose tape on hand or standard types sent in by customers. Company's laminating pressure-sensitive printer is used.—AVIATION, Aug., '45.

Toggle-Action Clamp 86

For use in aircraft construction, Model KV-210 toggle-action clamp made by **Knu-Vise, Inc.**, Detroit, is described as a light-duty large-capacity clamp with long



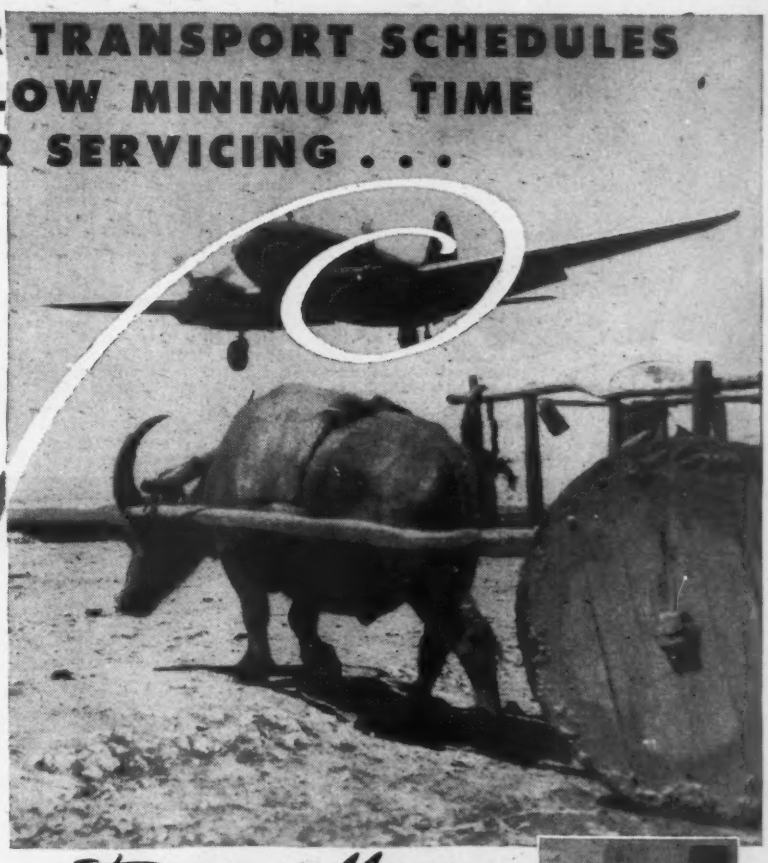
handle for leverage. Toggle bar can be reduced in length for mounting close to work. Bar can be used for direct clamping, or it can be equipped with spindle held by standard bolt retainer welded to end of bar.—AVIATION, Aug., '45.

Electrical Appliances

Volume Level Indicator 87

Designed primarily for use across balanced lines, Type 920 volume level indi-

AIR TRANSPORT SCHEDULES ALLOW MINIMUM TIME FOR SERVICING . . .



...That calls for

Slip-proof wing walks of WETORDRY Safety Walk

In she sweeps over ancient China—a modern American transport plane, complete with every aid to high speed operation, including non-skid wing walks of WETORDRY Safety Walk.

Slip-proof walkways on wings, etc., enable ground crews to go speedily and safely about refueling and double-checking the plane for the next fast hop, because it provides safe footing in spite of water, icing conditions, oil or grease. It is non-inflammable; will not crack or shatter under impact. If damage does occur it is easily and quickly repaired.

Always noted for ease and speed of application, WETORDRY Safety Walk now is more easily and speedily applied than ever, because it is pre-coated at the factory with two coats of WETORDRY Safety Walk Adhesive 613, eliminating all precoating at the point of installation. Use the coupon to secure a copy of our new book on uses of WETORDRY Safety Walk on ships, planes and in industry.

Available in rolls and cleats as illustrated.

MANUFACTURERS OF 3-M PRODUCTS

MINNESOTA MINING AND MANUFACTURING CO.

GENERAL OFFICES: SAINT PAUL 6, MINN. BRANCHES IN PRINCIPAL CITIES

A845

Minnesota Mining & Manufacturing Company
900 Fauquier Avenue, Saint Paul 6, Minnesota

Please send us a copy of your new book on WETORDRY Safety Walk.

Firm_____

Street_____

City_____ Zone____ State____

Signed_____ Title_____

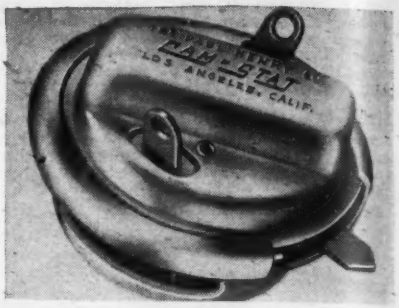
cator made by **Daven Co.**, Newark, N. J., also permits either side of bridged lines to be grounded. Indicator comprises copper-oxide type meter adjusted for deliberate pointed action, meter zero adjusting control, and heavy duty meter range control variable in steps of 2 VU (volume units), 100 to 130v. 60 cyc. a.c. power supply, with voltage regulator to adjust for normal supply variations. Its specifications are: Range, —20 to +20 VU at 0 VU meter reading; extreme range, —40 to +23 VU, including full meter scale; standard reference level, 1 mw. into 600 ohms; variation with frequency, less than 0.2DB. between 30 and 15,000 cyc. —AVIATION, Aug., '45.

Recording Galvanometer 88

Recordings of greater sensitivity and wider frequency range are reported from use of recording galvanometer manufactured by **Brush Development Co.**, Cleveland. Device embodies a low-mass 3-in. long tapered tube recording pen, actuated by permanent magnet penmotor utilizing newly developed materials and techniques. Pyrex tipped pen records directly in ink (on moving paper chart) pressures, vibrations, strains, currents, and voltages of frequencies from d.c. to 120 cps. It has no overshoot up to 70 cps. at max. swing amplitude of 20 mm. each side of center line, it is stated. Frequency response is flat to 70 cps., accurate to 120 cps. Impedance of penmotor is 1,500 ohms. Min. sensitivity is 1.1 mm. per volt, 1.6 mm. per ma., 21v. full scale. Dimensions are 5 in. high x 4 in. wide x 1⅝ in. thick. Weight is 4 lb.—AVIATION, Aug., '45.

Control Devices 89

Features of temperature, pressure, humidity, and mechanical displacement control devices made by **Paul Henry Co.**, Los Angeles, are stated to be: Special snap action arrangement; double break contacts; applicable range from —100 deg. F. to +600 deg. F.; enclosed contacts;



single-pole, single-throw, and single-pole double-throw, or independent circuit double-throw; resistance to vibration; low thermal lag; and adaptability to any mounting means. "Cam-Stat" controls are adjustable and are furnished with operating differentials as low as 1 deg. F. Thermostat illustrated weighs less than 1 oz. and is rated at 10 amp., 115v. a.c. or 28v. d.c.—AVIATION, Aug., '45.

Input Transformers 90

Intended for high quality amplifier requirements, 400 Series input transformers, produced by **Langevin Co.**, New York City, are described as combining high permeability shield with rotatable strap mounting for minimum stray field pick-up. Units are equipped with 10 in. "Supremant" color-coded lead. All of three types have max. operating level of +10 VU (volume unit) at .001 mw. reference level.—AVIATION, Aug., '45.

Low Frequency Crystal Unit.....91

Described as maintaining its frequency within narrower limits, Model FM6 low frequency crystal unit made by **Bliley Electric Co.**, Erie, Pa., has resonant pin assembly, steel pins being mechanically resonant to crystal frequency or some multiple of it, so that any damping effect of clamping pins is negligible.—AVIATION, Aug., '45.

Speedy Electronic Recorders.....92

Brown Instrument Div., Minneapolis-Honeywell Regulator Co., Philadelphia, has provided means of stepping up chart speeds of "Electronik" pyro-Potentiometers. Fast speed models, single or multiple point, are fitted with internally mounted gears for speeds of 10, 20, 30, and 40 in. per hour, twice speed of standard models.—AVIATION, Aug., '45.

Small Snap Switch 93

Complete in itself but also furnished with special over-travel adapters and special mounting sockets, "Junior" snap switch made by **Robert Heatherington & Son**, Sharon Hill, Penn., is of 9/16-in. dia. and 31/32 in. long. Pressure of 4 lb. is required to operate. Switch can be furnished normally-open, normally-closed, two-circuits, or single-pole double-throw. —AVIATION, Aug., '45.

FINISHES
MORE HOLES
PER
MAN-MINUTE

PATENTED
DUAL-SPIRAL
FINISHING
REAMER

Engine rebuilders tell us it's the best reamer made for finishing piston pin holes in just one cut. And there's none to equal it for reaming smoothly over oil grooves, keyways, etc. Shears satin-smooth finishes to close tolerances. 500% greater expansion range permits resharpening blades as many as 8 to 10 times! Sizes ½" to 3-3/32".

REAMERS DESIGNED
FOR
SPECIAL JOBS
MAIL BLUE PRINTS

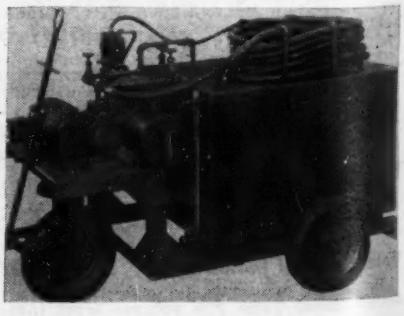
WRITE FOR CATALOG

LEMPCO
5717 Dunham Road • Bedford, Ohio

Aircraft Parts & Field Units

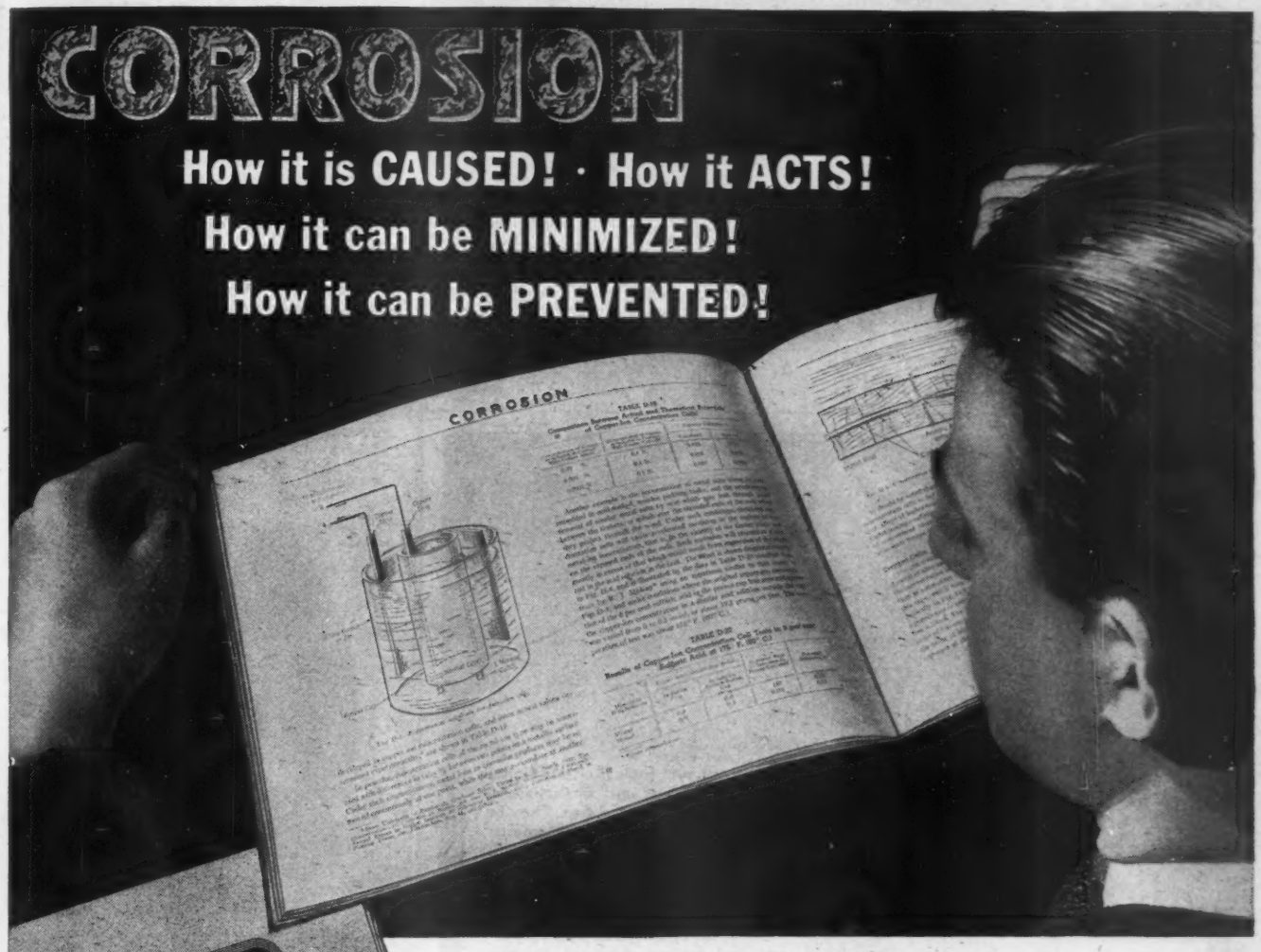
Engine Pre-Oiler 94

New item in maintenance equipment is No. 125 engine pre-oiler and oil transfer unit announced by **Pacific Airmotive**



CORROSION

How it is CAUSED! · How it ACTS!
How it can be MINIMIZED!
How it can be PREVENTED!



◀ FIND THE ANSWERS IN THIS NEW BOOKLET

You who design, build or operate aircraft and aviation equipment are in a constant fight against corrosion. Here's a booklet to help you make it a *winning* fight.

In 52 clearly written pages, most of what is known about corrosion has been reduced to a logical explanation of its causes, factors and modes of prevention.

Written by a staff of men whose special work is the study of corrosion, this booklet meets the need for an up-to-date understanding of this ever-present threat. So tear out the coupon and send for your copy now. "CORROSION" is a handy reference aid to have at your fingertips whenever you meet the problem of corrosion.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET, NEW YORK 5, N.Y.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Gentlemen:
Please mail me a copy of your new booklet "Corrosion."

Name.....

Position.....

A. 8-45

Company.....

Address.....

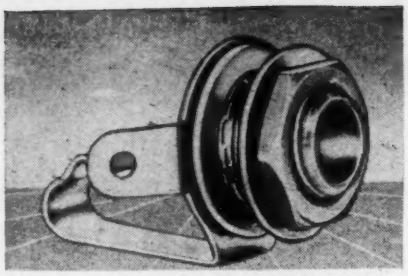
Corp., Glendale, Calif. Machine is rotary pump-vane type with built in by-pass valve. It has 125 gal. storage tank with two baffle plates, vent, 2-in. filler hole, drain plug, sight level gage, and calibrated hose rack. Capacity is sufficient to pre-oil 25 engines. Flow tank has 5 gal. cap. net. Unit is equipped with electric immersion heater (1,500 to 2,000 watt) temperature gage, with thermostatic control. Shut-off is automatic. Power is from ¾ hp., 220v., 3-phase motor, or 1 cyl., aircooled, 4 cyc., 1½ hp. gasoline motor with rope starter.—AVIATION, Aug., '45.

Gasoline Gages 95

Direct reading type gasoline gages for light aircraft are now being made by **Scott Aviation Corp.**, Lancaster, N. Y. Maker states that shielded magnetic transmission assures positive vapor and moisture proof seal.—AVIATION, Aug., '45.

Grounding Jack 96

New grounding jack offered by **Utah Radio Products Co.**, Chicago, is mounted



near filler cap of fuel tank, into which can be plugged a nozzle connection, providing a simple method of neutralizing static charges between aircraft and nozzle.—AVIATION, Aug., '45.

Portable Dry Oxygen Unit.....97

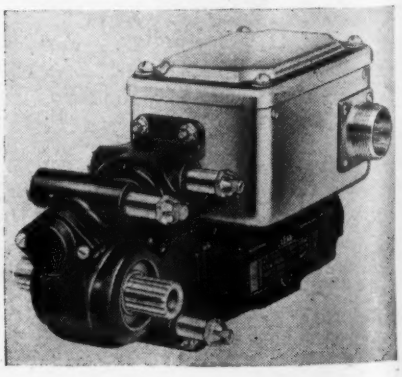
Capable of being flown, disassembled, to advanced bases is special oxygen unit produced by **Clark Bros. Co.**, Olean, N. Y. Broken down into individual pieces, each weighing less than 3,000 lb., and small enough to be loaded into Curtiss C-46 transport, unit can be filling cylinders within 24 hr. after landing. It is stated to produce more oxygen than other plants twice its weight. Low operating pressure of 100 lb. is employed. Also offered is a semi-trailer model weighing 10 tons and under 20 ft. long. Chemically pure oxygen is produced through use of compressor which operates without oil. Heart of unit is 6 ft. cold box where oxygen is produced by liquefying ordinary air, then allowing liquid to boil in such a way that its oxygen and nitrogen vaporize separately. Development of unit is reported to have uncovered several postwar possibilities for which oil-free compressed air will be useful.—AVIATION, Aug., '45.

Remote Control Searchlight.....98

Operated by compressed air from regular airport supply, searchlight developed by **General Electric Co.**, Schenectady, N. Y., is controlled remotely by means of handle located in tower or other location. Equipment is gear box surmounted by two piston-type reversing air motors. A double shaft, bolted to searchlight, protrudes from top. Air is fed to motors through four-way universal hand-operated valve. Two air pipes leading into each motor are connected to valve. Incandescent or mercury-arc type are available. Usually, 24-in. size is furnished, but 12- and 18-in. sizes are available—AVIATION, Aug., '45.

Rotary Actuator 99

Lear, Inc., Piqua, Ohio, announces Model 111 Series special low-speed rotary actuator for landing gears, wing flaps, and other purposes, handling loads up to



Why
THEY KNOCK 'EM DOWN
It's not just luck that our fighting men have an unsurpassed record for accuracy of fire. They're good; but so is their equipment.
A small but important item in this equipment is NICHOLS reticles. Lyman Nichols makes these glass reticles (used in range finders, binoculars and other sighting and testing devices) for the Army, Navy and Air Corps.
The reticles are diamond-etched with a NICHOLS Pantograph so accurate that with it more than a hundred words can be engraved within the area of a typewriter dot.
The joints of the pantograph must be kept in delicate alignment; yet they must be free for easy manipulation — so Mr. Nichols chose MPB pivot bearings.
When mechanisms must be free — yet precise, strong and compact, let MPB engineers work with you. No obligations. Write for full bearings specifications.
SEND FOR CATALOG A-45
SCALE = ENLARGED 7 TIMES GRADUATIONS ARE ACTUALLY THOUSANDTHS OF AN INCH.
←ENLARGED 4 DIAMETERS
←ACTUAL SIZE
MINIATURE Precision BEARINGS
KEENE, NEW HAMPSHIRE, U·S·A·

600 lb.-in. and operating at speeds as low as 2.2 rpm. Speed and output torque is varied by using different gear ratios. Regular models are equipped with double-ended ⅝-in. 16-tooth spline, but special output shafts are available. Output shaft rotation is normally less than 360 deg., with reversible operation. Actuators are powered by "C" frame motors with "Fastop" clutch, and thermal protectors are standard. Motors may have as much as 30% higher torque for one direction.—**AVIATION, Aug., '45.**

Battery Receptacle 100

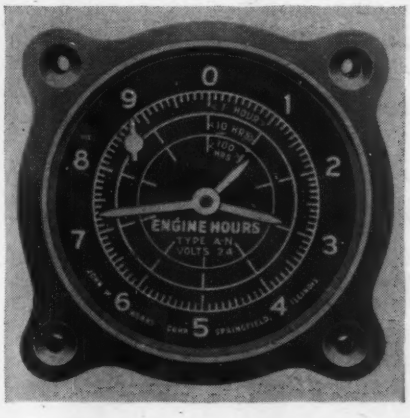
Adaptable to aircraft starting equipment, and mating with any standard AN2551 plug, new three-contact battery receptacle is available from **Cannon Electric Development Co.**, Los Angeles. There are four combinations: AN2552–1, complete fitting with shield and three pin contacts; AN2552–2, shield less small pin contact; AN2552–A1, panel without shield but with small pin contact; and AN2552–A2, panel without small pin contact.—**AVIATION, Aug., '45.**

Airport Loudspeaker 101

Suitable for airport use, Model B-6 high powered directional loudspeaker for use through high noise levels, with 1 mi. range, has been developed by **University Laboratories,** New York City. Completely waterproof, six driver units, connected in series with high impedance reactor shunted across each coil, power the speaker. Dia. is approx. 18 in., length over-all is 24 in., and weight is 60 lb. A collapsible tripod stand is available for mounting.—**AVIATION, Aug., '45.**

Engine Hour Meter 102

John W. Hobbs Corp., Springfield, Ill., has developed meter for indicating hours, and accumulated number of hours, for aircraft use. Meter can also be used as flight hour meter. Hours are indicated by three hands, one of which turns one complete revolution in 10 hr., another one revolution in 100 hr., and the third, one



revolution in 1,000 hr. For engine hour indication, meter can be operated with ignition switch or special oil pressure switch. For use as flight hour meter, switch can be located on landing gear, fitted to start meter when flight begins and stops it when flight ends. Available in 6, 12, and 24v., d.c. types, meter measures approx. 2⅞ x 2½ in., and weighs 7 oz.—**AVIATION, Aug., '45.**

Pontoon Joint Sealer.....103

Marine Batten Dolfinite No. 1780 is new synthetic-resin oil-base sealer for joints and seams of floats and pontoons, and also for coating or impregnating joint tape for water and airproofing. It is reported to be non-corroding and to have no deteriorating effect on aluminum, stainless steel, or other alloys. Maker is **Dolphin Paint & Varnish Co.**, Toledo.—**AVIATION, Aug., '45.**

Metallic Bellows 104

Described as sensitive, uniform, and long lived, metallic bellows made by **Autoflight Div., G. M. Giannini & Co.**, Pasadena, Calif., are engineered to specifications of customers, in many metals, and are also mass produced in standard types and with standard characteristics. Quick delivery from stock and also speedy service with experimental bellows is stated to be afforded. Complete control units, such as pressure switches with bellows, are also available.—**AVIATION, Aug., '45.**

In ordering your permanent mold aluminum castings from Acme you supply the blueprint, and Acme does the rest. Your casting is poured in an Acme mold that is made from an Acme pattern. You can rely upon an Acme mold to have proper gating and risering, permitting pouring at correct temperatures. Acme's centralized responsibility is particularly important in permanent mold work, where one mold may affect the quality of thousands of castings.

Acme made tools and patterns even before it made castings. And today, Acme engineering experience unites with advanced foundry practice to give you the finest possible results. For permanent mold castings with finer grain, greater strength, and maximum dimensional accuracy—and machined ready for assembly—secure the facts on Acme Castings today. Recommendations and quotations submitted promptly.

PATTERN MAKING
Backed by a Quarter Century of Experience

MAKING THE MOLD
Controlled by Advanced Engineering Standards

POURING THE CASTING
with Laboratory-Tested Alloys

CASTINGS FINISHED
to Exact Dimensions Ready for Assembly

ACME *Aluminum Alloys, Inc.*
Formerly Acme Pattern & Tool Co., Inc.
DAYTON 3, OHIO
PATTERNS • TOOLS • ALUMINUM CASTINGS • ENGINEERING

VICTORY, first: THEN—

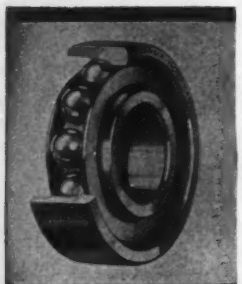
PRECISION BEARINGS FOR EVERY PURPOSE, INDUSTRIAL AND DOMESTIC

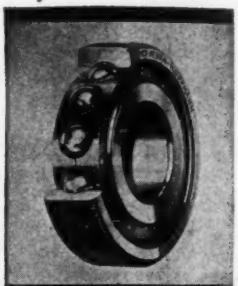
War's demands still call for all the output of the NORMA-HOFFMANN factory. But, already, far-sighted manufacturers are working with NORMA-HOFFMANN engineers on their designs for new and better peace-time products equipped with PRECISION BEARINGS.

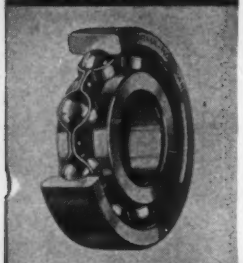
No "Re-conversion Problem" will hamper or delay NORMA-HOFFMANN post-war production. The moment peace is declared, all our vast facilities will be turned INSTANTLY to the production and prompt delivery of PRECISION BEARINGS for new and better domestic appliances and for new and better tools for industry.

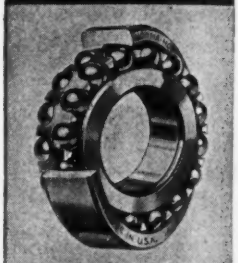
Our Field Engineers, in all our District Offices, are ready to work with YOUR designers. Avail yourself of their experienced counsel NOW—without obligation, and of course in strict confidence. *Write for the Catalog—Today.*

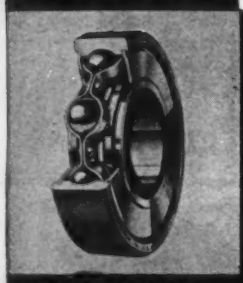
TO WIN THE WAR: WORK—FIGHT—BUY WAR SAVINGS BONDS!

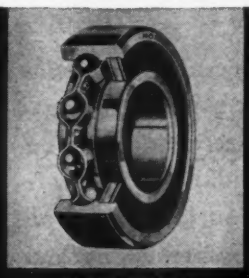

Separable (Magneto) Ball Bearing

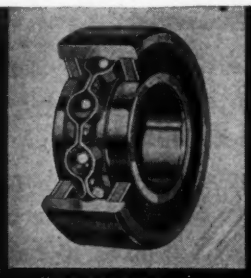

Litro ("CL") Composition Retainer Ball Bearing

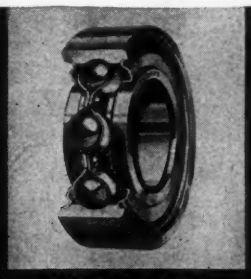

Single Row Ball Bearing

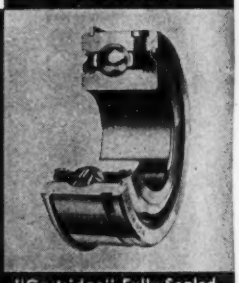

Double Row Self-Aligning Ball Bearing


Shielded Type Single Row Ball Bearing


Single Felt Seal Ball Bearing


Double Felt Seal Ball Bearing


9000 Series (Feltless) Sealed Ball Bearing

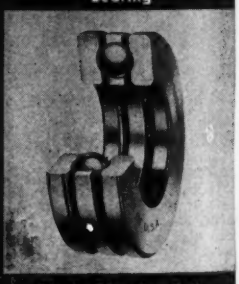

"Cartridge" Fully Sealed, Refillable Type Ball Bearing

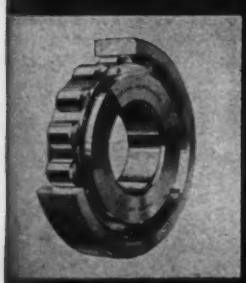
Double Row Ball Bearing

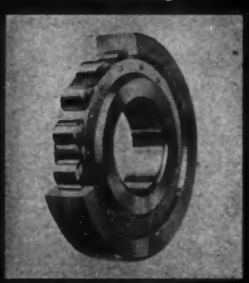
Extra Light Type Ball Bearing

Angular Contact Ball Bearing

Extra Light Single Direction Ball Thrust Bearing

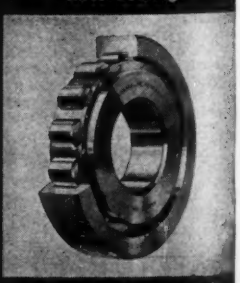

Single Direction Ball Thrust Bearing


Standard Cylindrical Roller Bearing


Type "E" Cylindrical Roller Bearing

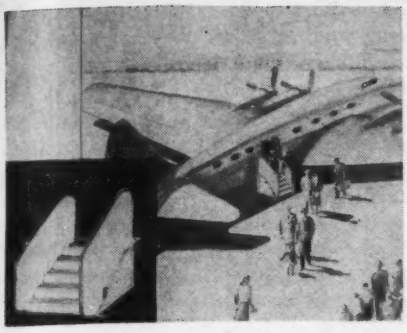
Full Type (Retainerless) Cylindrical Roller Bearing

Extra Light Cylindrical Roller Bearing


Two-Lipped Cylindrical Roller Bearing

NORMA-HOFFMANN BEARINGS CORP'N. STAMFORD, CONN. *Founded* 1911

Field Offices: NEW YORK • CHICAGO • CLEVELAND • CINCINNATI • PITTSBURGH • DETROIT • LOS ANGELES • SAN FRANCISCO • SEATTLE, WASH.

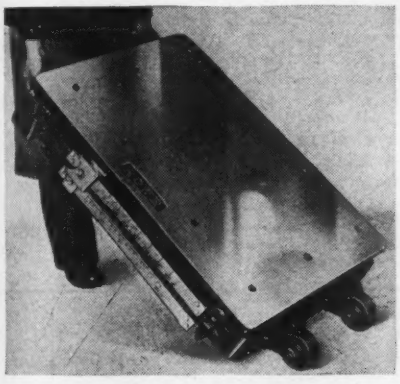


Loading Platform 105

Illustrated is passenger loading platform manufactured by **Aircraft Mechanics, Inc.**, Colorado Springs, Colo. It is described as durable, good looking, and easily handled.—**AVIATION, Aug., '45.**

Portable Cargo Scale.....106

For use by operator who must weigh cargo at air fields lacking equipment, **Howe Scale Co.**, Rutland, Vt., has pro-



duced scale weighing 185 lb, with capacity of 5,000 lb. Two beams are provided, lower of which has 2-lb. graduations. Platform measures 24 x 36 in.—**AVIATION, Aug., '45.**

ANNOUNCEMENTS—

of new machinery, shop equipment and materials, electrical appliances, and aircraft parts and field units are invited.

In writing, emphasis upon specific aviation applications of newly-marketed items is desirable. Also, whenever possible, glossy-print photos should be enclosed. Please do not send electros. Address—

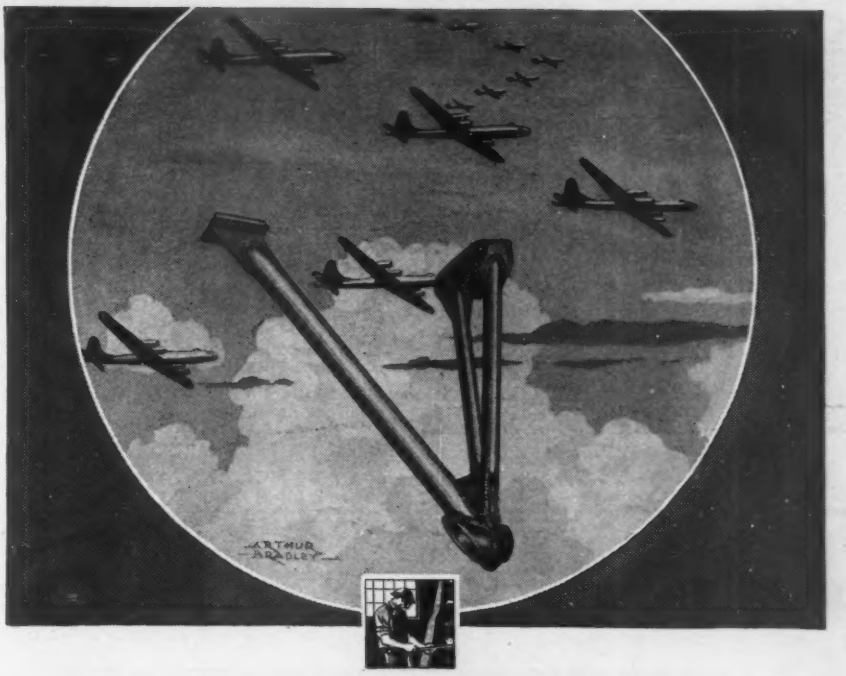
New Products Editor, AVIATION
330 W. 42d St., New York City 18

Otto Aviation Base

(*Continued from page* 165)

cross-country and advanced training, also several Waco C cabin planes which the company subsidiary, Otto Airlines, operates on a twice-daily round-trip schedule between Blairstown, Teterboro, and Atlantic City. The company also has an application pending before the CAB for a regularly scheduled New Jersey intrastate route covering 26 communities.

The combination operations office and waiting room is comfortably out-



SYMBOL OF VICTORY...
WROUGHT IN STEEL!

Steel tubing—plus steel forgings—plus the "know-how" of precision manufacturing . . . equals vitally necessary parts for war planes for Uncle Sam and his Allies.

Here at Aircraft Mechanics, Inc., are fashioned thousands of forgings and welded tubular structural units for assembly into the fighting, bombing and cargo carrying aircraft which play such an important role in the defeat of the enemies of Democracy.

Each of these units—symbols of victory wrought in steel—are precision manufactured. Tolerances often are in the tenths of thousandths. The skills to obtain such tolerances have been developed on our own production lines.

Now, our Army and Navy receive 100% of the production we produce. Tomorrow, this manufacturing "know-how" . . . our modern machinery and facilities . . . and our war tested manpower—can serve you.

Write us, today, for full particulars regarding our ability to produce quality goods within the time schedules most satisfactory to you.

BUY UNITED STATES WAR BONDS AND STAMPS

★ **AIRCRAFT MECHANICS** INC.
COLORADO SPRINGS, COLORADO

DESIGNERS • • • ENGINEERS • • • MANUFACTURERS

fitted, and it affords a good view of the field and flying activities. A glass showcase displays flight gear and accessories. The ground school seats 25, and for visual instruction there are a Continental engine mounted on a stand and an uncovered wing and fuselage. Maintenance charts are mounted on the walls. A door leads directly into the main hangar from the school.

Overhaul and maintenance facilities are situated in a separate building facing the main hangar. This structure is divided into three sections, oil and parts storage, the shop, and a combined hangar-paint shop. It is stated that due to having equipment not ordinarily found at private airports the shop is also handling overhaul and rebuilding work on planes purchased by private and commercial operators from military surplus stocks. An example of such "extra" equipment is a complete service for Magnaflux inspection of steel parts.

Student enrollment now totals about 80, with 15 to 20 percent of these being girls. The company has an arrangement with nearby Blair Academy through which special rates are given to the school's students. It is stated that this has shown good results and that a large proportion of the student body is airminded. Advantage is that the airport is near enough to the academy so that pupils may visit the field without inconvenience and thus build up an interest in learning to fly.

Bowman Otto put it this way: "Here at Lake Susquehanna we have built an airport that has all types of flight facilities, hotel and restaurant accommodations, and the opportunity for all kinds of sports. We believe that it will be both a vacation and week-end spot for many pilots in the New York and New Jersey areas."

With this, plus a good maintenance base, plus an airline, this operator can readily make his opportunities grow—and pay dividends.

Otto Aviation's Shop Equipment

Atlas 36 in. x 6 in. back-geared screw cutting lathe.
Walker-Turner 10 in. table saw.
Walker-Turner ½ in.–½ hp. drill press.
Magnaflux Type XTV washer.
Magnaflux Type TF-203R inspector.
U. S. Electrical Co. 6 in.–¼ hp. tool grinder and wire brush.
Famco Machine Co. No. 2 arbor press.
Gray Mills Type P70A portable parts washer.
Lynch Type 15 1½ hp. air compressor.
GE Model 6RB33B2 Tungar battery charger.
No. 2 metal brake.
Howe 500 lb. weighing scales.
AC Model F sparkplug cleaner.
De Vilbiss Type QM-50-92 pressure feed spray tank.

Crop Dusting

(*Continued from page* 167)

has been found that a very small percentage of the total time involved is taken up by the actual dusting operation. Rain, even showers, can wash away the insecticides as fast as they are applied. Wind will prevent even distribution, though the area may be sufficiently isolated so that neighboring farms are not harmed. Steep hillsides are difficult to dust unless there is a wind blowing towards the slope, and if this wind becomes too strong the work will be impossible.

Fortunately, the advantages are such that crop dusting—for the experienced operator—is not only good business, but good farming as well. To begin with, an acre can be dusted in a few seconds, and frequently 500 acres have been covered by one pilot in an hour. In fighting insect pests, time is of the utmost importance, since a few days in the life of a "bug" will mean the difference between success and failure of the dusting. It is essential to catch them during that period when they are vulnerable to the dust, and because an entire crop will be infested with insects in the same stage of development, the work must be done fast or it will be useless.

An instance of this is given by a planter on the west coast of Mexico who dusted 7,500 acres of tomatoes and 500 acres of peas with one plane, doing

AIRCRAFT ALLOY BARS
...QUICKLY AVAILABLE
FROM RYERSON STOCKS

Convenient delivery from:

CHICAGO.. .....16th and Rockwell Sts.
Rockwell 2121

NEW YORK.....203 Westside Ave.
Jersey City, N. J.

New York City.....Rector 2-3700
Newark .....Market 2-6067
Jersey City .....Bergen 4-1123

Other Steel-Service Plants

MILWAUKEE • DETROIT • ST. LOUIS
CINCINNATI • CLEVELAND • BUFFALO
PITTSBURGH • PHILADELPHIA • BOSTON

Joseph T. Ryerson & Son, Inc.

Aircraft Quality Stocks:

8630 ROUNDS
Conforms to specification AN-S-14a. Cold finished annealed — cold finished heat treated — hot rolled annealed.

8630 HEXAGONS
Conforms to specification AN-S-14a. Cold finished heat treated.

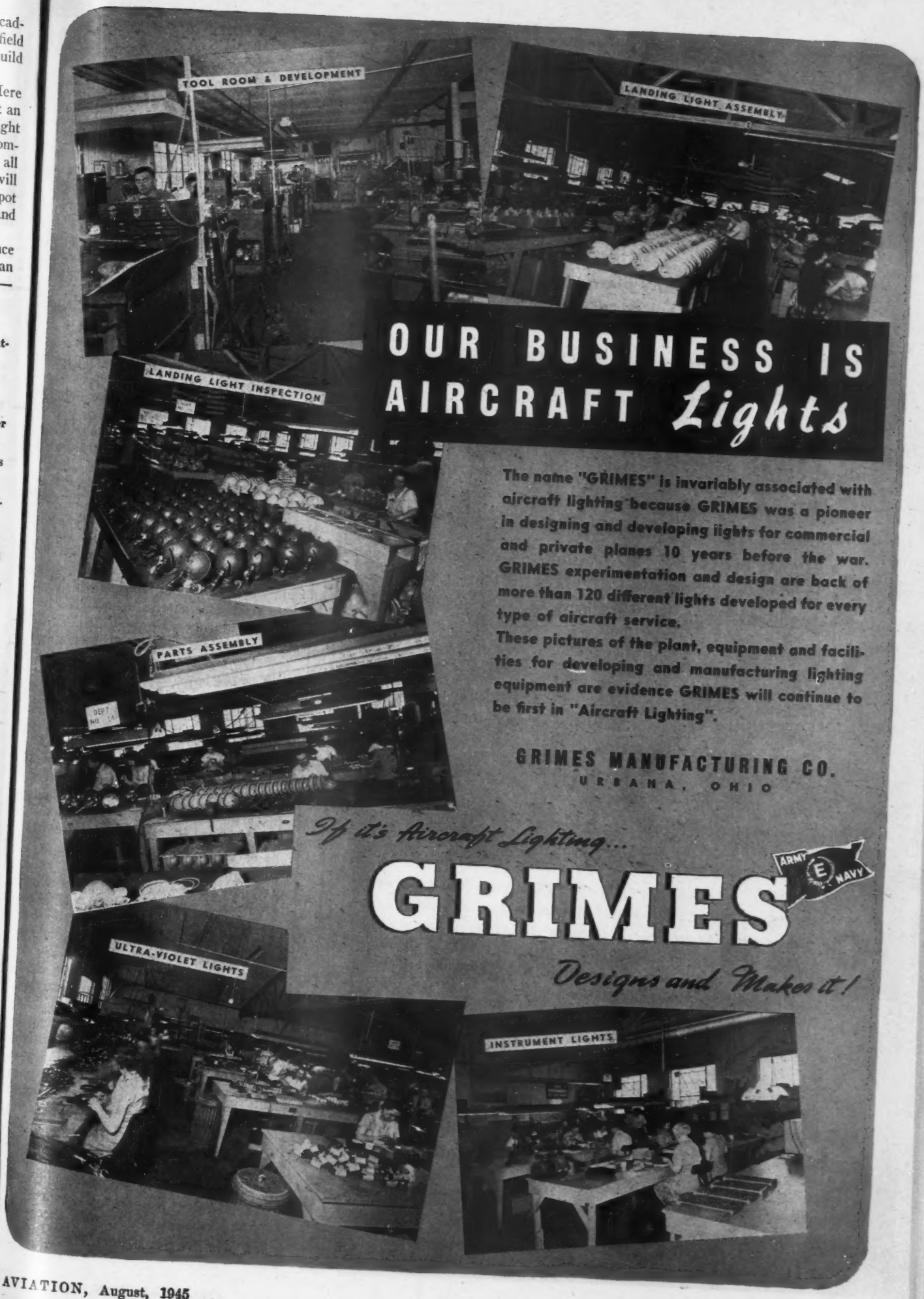
4130 ROUNDS
Conforms to specification AN-QQ-S-684a. Cold finished annealed — cold finished heat treated—hot rolled annealed.

4130 HEXAGONS
Conforms to specification AN-QQ-S-684a. Cold finished heat treated.

8740 ROUNDS
Conforms to specification AN-S-16a. Cold finished annealed — hot rolled annealed.

4140 ROUNDS
Conforms to specification AN-QQ-S-752a. Cold finished annealed — hot rolled annealed.

RYERSON STEEL


TOOL ROOM & DEVELOPMENT
LANDING LIGHT ASSEMBLY
OUR BUSINESS IS AIRCRAFT Lights
LANDING LIGHT INSPECTION
The name "GRIMES" is invariably associated with aircraft lighting because GRIMES was a pioneer in designing and developing lights for commercial and private planes 10 years before the war. GRIMES experimentation and design are back of more than 120 different lights developed for every type of aircraft service.
These pictures of the plant, equipment and facilities for developing and manufacturing lighting equipment are evidence GRIMES will continue to be first in "Aircraft Lighting".
PARTS ASSEMBLY
GRIMES MANUFACTURING CO.
URBANA, OHIO
If it's Aircraft Lighting...
GRIMES
ARMY E NAVY
Designs and Makes it!
ULTRA-VIOLET LIGHTS
INSTRUMENT LIGHTS

NORTON ABRASIVES

TO EVERY USER OF SET-UP WHEELS

HERE'S WHY so many plants have cast out set-up wheels for

Abrasive Belts—Idler-Backstands

They gained all these advantages:

- Factory-controlled, uniformly sharp cutting surface
- Choice of 17 grit sizes (24-Coarse to 500-Fine)
- Instant Change from one grit to another
- Higher Speeds, Cooler Cutting, Better Finish from
- Greater abrading area (averages 3 to 1) and
- Resilient Contact Wheel

As Contrasted with:

Difficulty of duplication—at best a massive surface
Wasteful, messy job of rolling loose abrasive into wet glue
Down-time to make grit (wheel) changes
Time and space lost in preparation and storage
Hard, unyielding cutting face

•

YOU WILL BE INTERESTED in our new, illustrated eight-page folder, "PLUS FACTORS," telling the advantages of Idler-Backstands in greater detail. It describes ease of change-over, shows pictures of actual installations, gives reports on increased output (up to 17 to 1), the makes of machines on the market and convincing testimony to the benefits of this modern, easy, economical conversion method.

Use the Coupon

•

BEHR-MANNING, TROY, N.Y.
(DIVISION OF NORTON COMPANY)

BEHR-MANNING, TROY, N. Y.
Please send your new 8-page folder, "PLUS FACTORS," on Idler-Backstands.
Company.....
Per.....
Address.....
☐ Please have Field Engineer call.

work which would have required 1,800 men—if he could have obtained them along with enough machinery to keep them busy. In another case, a city park was infested by caterpillars. Ground spraying was too slow and necessitated the exclusion of the public during the hottest part of the year when the facilities of the park were in greatest demand. The grove in question was 800 ft. long and 325 ft. wide. At any rate, the actual dusting time was *54 sec.*—done in the early morning before people filled the park. Result was that 99 percent of the insects were killed and the grove was saved.

Another advantage possessed only by the airplane is that infestation spots in large crop areas can be spotted from the air while they are still small, and before sufficient damage has been done to permit observation from the sides of the field.

In the Philippines, locust control has been found effective only when the airplane was used. By dusting around the insects in the early morning, before they commence flying and then dusting in front of them while in flight, it was found that entire swarms of locusts could be destroyed. Previously, the only effective method was to start a ring of fire, which frequently did as much damage as the insects.

As a business, crop dusting (and other uses of the plane in farming) can be made to pay a good profit. Across the letterhead of "Red" Jensen, of Sacramento, Cal., there is the headline: "Crop Dusting—Rice Planting—Liquid Spraying—Fertilizing—Weed Control, Wet or Dry." And below this is the line, "Jensen Crop Dusters . . . Since 1930". When a man has stayed in the same business at the same place for 15 yr. he has not only made it a success, but he knows well what he is doing.

In another part of his letter Jensen says, "Average cost of application is from 4¢ to 5¢ per lb., but within the past eight months there has been an influx of inexperienced operators who have forced the price down to 2½¢ per lb., compelling experienced and established dusters either to compete at a loss or store their equipment."

The foregoing statement should be memorized by anyone who hopefully contemplates using crop dusting as a means of getting rich quickly. A man of little or no experience—regardless of how good a pilot he may be—needs to learn a lot before he starts in this business. After he has learned what to do and how to do it, he must remember that there is no money in working at a loss. In fact, the more business he obtains in this way, the sooner he will be out of business. Unfortunately, in every branch of industry

there are a temporary few who seem never to have heard of this fact.

Acquiring experience in dusting should not be difficult for the pilot who has logged sufficient hours to give him expert flying ability. Many of the larger dusting operators are willing to teach men with these qualifications. H. A. Poulin, of Central Airport, Yakima, Wash., states, "I need good pilots. I will teach them how to apply dusts and liquids, give them a course in elementary entomology, and pay a good salary. By the end of a year they should have sufficient experience."

Area which can be covered per hour is extremely variable. Open fields permitting long runs can be dusted at a rate of 400–500 acres per hour, while vineyards "hemmed in as usual with wires, trees, buildings, and irrigation standpipes," generally require an hour of flying time for each 40 acres.

For the benefit of those who would make their our dusting hopper, we give the following design and specifications by the U. S. Dept. of Agriculture:

Preliminary considerations for the hopper suggested certain essential principles without structural changes in the plane: (1) a hopper with smooth, perpendicular walls to permit materials to settle to the bottom; from which they would be fed out by (2) an endless chain conveyor moving over the false bottom of the hopper; (3) an adjustable door at the front of the hopper bottom; through which the conveyor would deliver material to (4) a venturi tube parallel to the airflow and below the fuselage; whence it would be driven by the rush of air beneath the plane and distributed in its wake; and (5) a wind-driven propeller to operate the mechanism through a reduction gear, with a brake controlled from the pilot's seat. Details are given in accompanying drawings.

Dimensional alterations would permit this mechanism to be used with any airplane. The hopper described is of 29 cu. ft. capacity, for installation in a biplane powered with a 285 hp. engine with a cruising speed of 90 mph. and a payload—including hopper—of 984 lb. at takeoff.

Mounting Hopper Unit

The hopper is mounted behind the firewall and fills the front of the cockpit at the CG of the plane. To insure safety and permit licensing, this hopper should be installed by mechanics thoroughly acquainted with the mechanism of the aircraft.

The hopper is attached to the top longerons by 1½-in. T-sections, while the bottom rests on the lower fuselage members, with wood strips clamping the hopper and conveyor unit in place. Hopper is also bolted to top cowling.

Power unit, comprising a small propeller and reduction gear, is mounted on a bracket outside the fuselage and clamped to the longerons. These latter are protected by wood blocks and ⅛ in. wood strips. No parts of the hopper are attached to the fuselage without intervening wood or rubber.

As the weight of the load changes, the CG is still within the range for which the plane is approved.

Specifications for Hopper

Hopper is of sheet aluminum and uses all available space in the fuselage, the hopper bottom being approximately the width of inside fuselage. Hopper has an adjustable door over outlet end of conveyor to regulate amount of material. Walls are supported by angle braces, and sheet aluminum door is 27 x 37 in., with the cowling well braced round the opening.

Drag-link conveyor has links made of ½ x 1 in. 17 ST aluminum angle, 4 in. apart. Malleable iron No. 32 chain is used, with R and L A-1 attachments. Conveyor is as closely as possible full width of the hopper bottom and is driven by four No. 32 8-tooth sprockets on ¾ in. shaft. Sprockets should be turned out as light in weight as possible. Shafting is supported by dustproof, rubber, pillow

Teamwork—

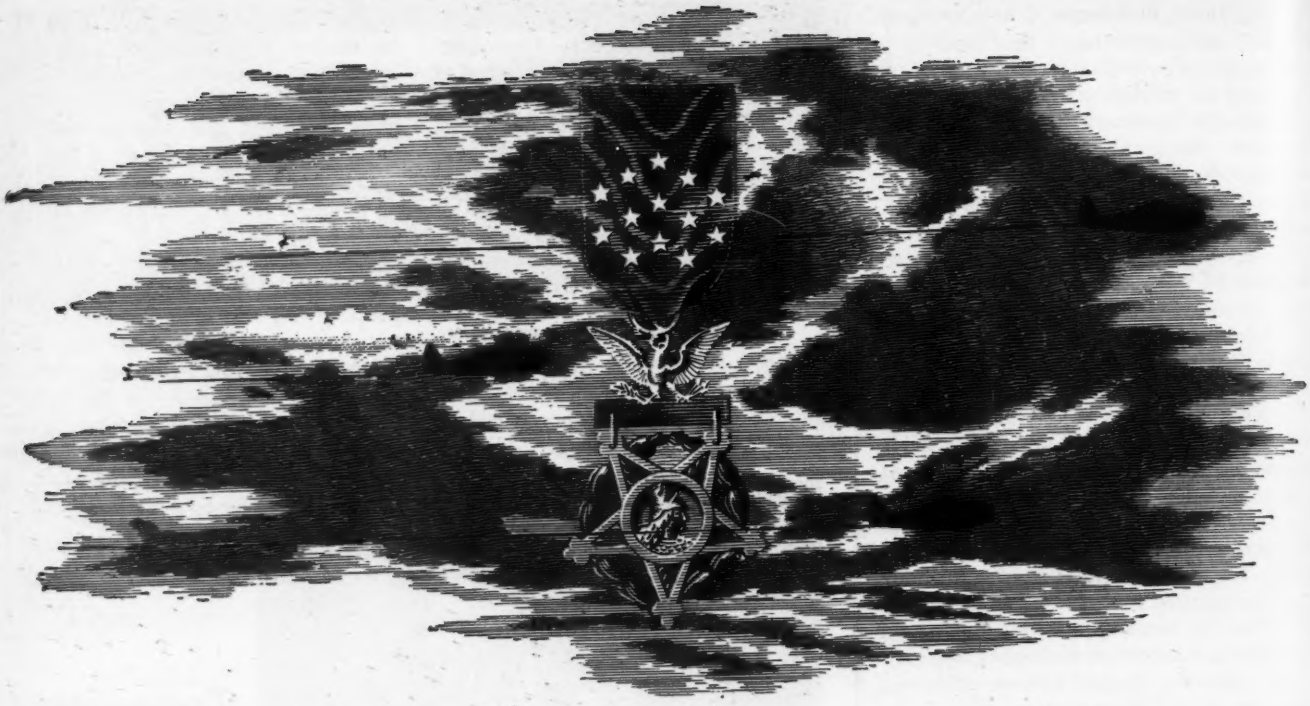
complete synchronization—all members of a smoothly functioning production team.

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS - DETROIT, MICHIGAN



Above All

"Over and above the call of duty"... begins the citation of a coveted but never calculated award, for with that simple acceptance of the moment's need, so aptly phrased in the inimitable slang of one immortal Ace, many a pilot "has seen his duty and done it." ☆ ☆

So, too, must the plane measure up in performance and ruggedness to necessity's exacting demands, and we are proud to stress that American planes of all makes and types have delivered a magnificent performance to the honor and glory of the Air Corps.

It is, however, our gratifying privilege to point to records set by the Thunderbolt on all fighting fronts which not alone demonstrate its versatility, but "over and above the call of duty" stress its well merited reputation for "bringing them back alive."

REPUBLIC AVIATION
CORPORATION

Farmingdale, L. I., N. Y. — *Makers of the Mighty Thunderbolt* — *Evansville, Ind.*

block ball bearings mounted to permit adjustments to be made on conveyor. Felt washers are used between bearings and conveyor box sides. Conveyor box is .065 aluminum braced with 1¼ in. angles. Hopper floor under conveyor chain is .091 aluminum with 1¼ T-section supports. Conveyor is bolted to hopper bottom, thereby clamping the assembly to the lower fuselage members, which are protected by wood, fabric, or rubber. Door, of full hopper width, should open at least 6 in. It is dustproof when closed and is made of .187 2S, ½H sheet aluminum.

Venturi is adjustable and is full width of conveyor box. Tube is made of 17ST aluminum alloy.

Power unit is provided with 18-in. dia. propeller connected to 48 : 1 reducing gear on side of fuselage. A brake with 1 in. wide drum is mounted on propeller shaft and is connected by .187 cable to hopper door control. This is for the purpose of stopping the conveyor drive when hopper door is closed, preventing material from being packed into bottom section and damaging the mechanism.

Twelve tooth No. 41 sprocket is mounted on gear box, while conveyor shaft may use 24-, 30-, or 45-tooth sprockets for varying speeds of conveyor. Mounting bracket is clamped to upper and lower longerons.

Controls for hopper door and propeller brake are in cockpit and are accessible to pilot.

All outlets and openings where controls or cables enter fuselage or wings, should be protected by socks to prevent entry of dust.

Plan for Feederlines

(*Continued from page* 171)

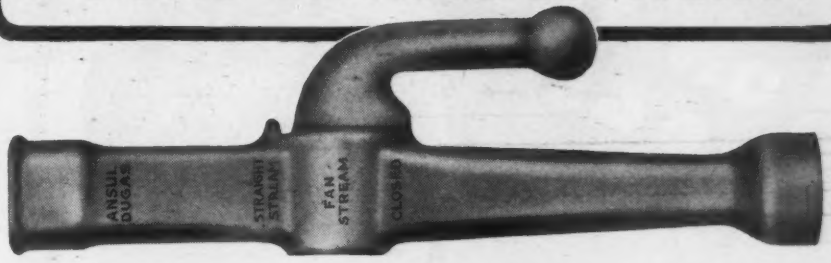
When there is good snow, there is a peak load, but when the snow cover goes bad, the bottom drops out of this source of revenue in a few hours.

Area Certificate Proposed

The Port of New York Authority recently suggested to the CAB that it consider the issuance of an entirely new type of certificate for non-trunkline service—the area certificate. Such a certificate would grant a carrier the right to provide non-trunkline service within a described region. It would be written in such a way that the carrier would be left considerable discretion as to the precise towns to be served on particular schedules, thus providing a flexible operation. The carrier could then adapt the service to the need, with variance according to seasonal and other factors.

In considering the merits of secondary airline service, it must be remem-

NOW...NEW DUAL-STREAM NOZZLE
further steps up fire-killing punch of
DUGAS EXTINGUISHERS!



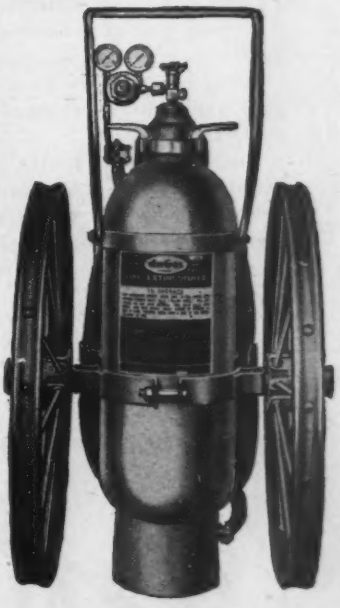
NEW DUAL-STREAM NOZZLE deals effectively with spill fires and fires difficult to reach because of height or obstructions. Designed for use with DUGAS wheeled extinguishers, the new Dual-Stream Nozzle greatly increases fire fighting range and effectiveness. A turn of the handle gives a *straight* stream with a range of 45 feet—or a *fan* stream with a range of 15 feet.

STRAIGHT STREAM of fire-killing DUGAS Dry Chemical permits a large fire to be knocked down from a safe distance before operator goes in to extinguish it.

FAN STREAM enables operator to concentrate heavy cloud of DUGAS Dry Chemical on fire and minimizes flash-backs.

***Quick Facts about* DUGAS Dry Chemical**

- For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
- Not an electrical conductor.
- Non-toxic, non-corrosive, non-abrasive.
- Not affected by extreme cold or heat.



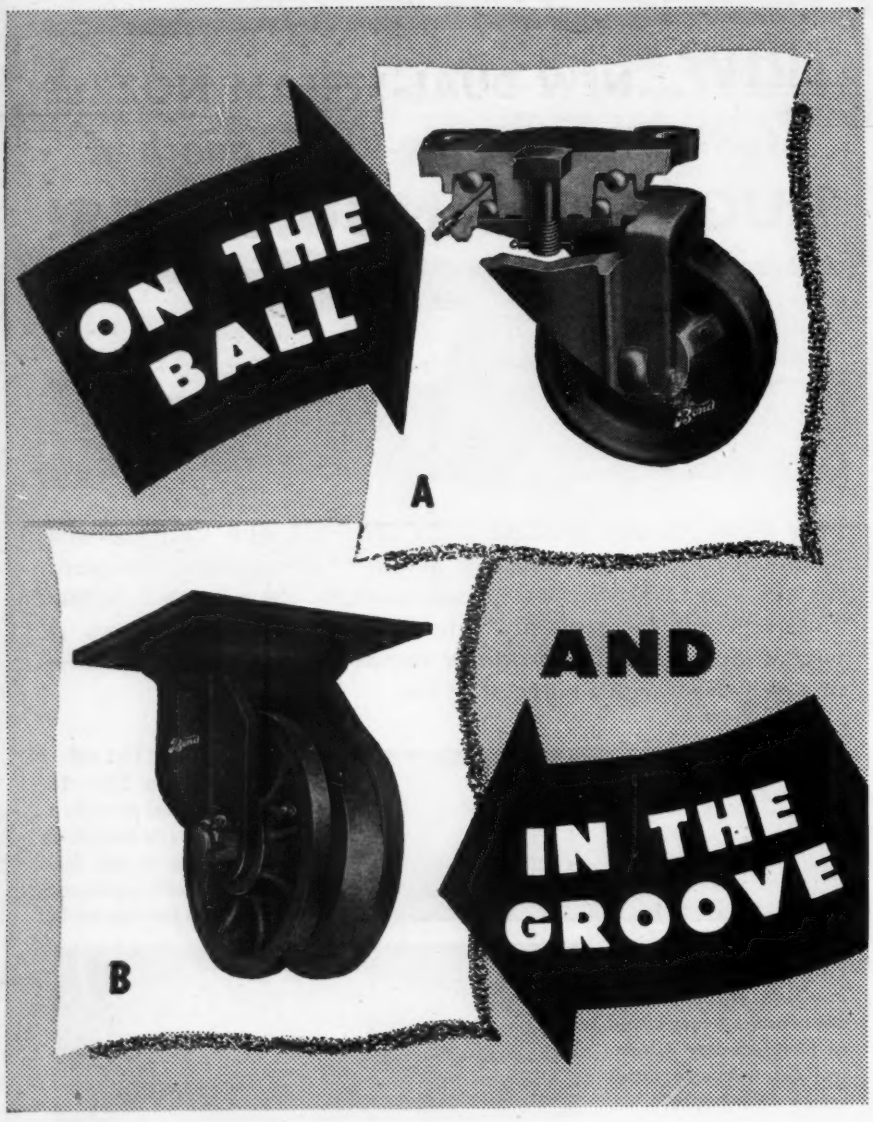
DUGAS 150-A WHEELED EXTINGUISHER

Write today for complete information regarding DUGAS Wheeled Extinguishers with the New Dual-Stream Nozzle... and DUGAS Hand Extinguishers.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME

Approved by Underwriters' Laboratories, Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION



THAT not only describes two of the most popular models in the Bond line of industrial casters—it characterizes the wide-awake production men who standardize on Bond casters in their plants.

Bond users never have to accept casters that are "almost" what they want—they're assured of getting the *right* caster for the purpose, every time.

Bonds come in a wide variety of styles and sizes—to meet every requirement of modern industry.

Write today for the free Bond catalog . . . and select the proper truck casters for your materials handling needs.

★ ★ ★ ★ ★

(A) Bond 136-A Caster. Combines easy swiveling with long service because of special double ball race design and use of durable Bond caster metal. Pressure lubricated throughout.

(B) Bond V-Grooved Wheel Caster. Built especially for use on track line assembly. Saves time and floor space—reduces effects of floor vibration. Pressure lubricated throughout.

BOND FOUNDRY & MACHINE COMPANY, MANHEIM, PA.

Bond Reg. U. S. Pat. Off.

TRUCK CASTERS
Built-for-the-Job

bered that the entire United States is divided, either by geographic or economic boundaries, into a series of areas which could be efficiently served by such airlines. Many communities may themselves never originate sufficient daily business to qualify as a profitable stop for the multi-passenger trunkline aircraft of the future; however, their annual total transportation requirements probably will add up to a nice business for a local operator who is able to shift his activities to any part of the area accordingly as the service is required.

Non-trunkline air service will complement, rather than compete with, the trunklines. Through the development of an extensive network of such routes, a great deterrent to full development of air transportation will be removed—that is, the present inability of the clientele to travel by air from a major city to communities off the trunklines.

Feederline service holds out the promise of intensive cultivation of the short-haul air market. The average non-commuting rail trip is 144 mi., while 99 percent of auto and 90 percent of bus travel is within a radius of 250 mi. Only 2 percent of airline travel is now for less than 250 mi., and most of this is within the thickly-populated sections around Chicago and New York.

Development of air transport as a medium of transportation will require the optimum development of short-haul services. Accompanying this article are maps of two areas—one industrial and heavily populated, the other mainly agricultural—with several cities of importance.

For example, in the State of Louisiana, the City of New Orleans is served by five airlines: Delta, to Ft. Worth and Atlanta; Eastern, to Houston and Atlanta; National, to Jacksonville; C & S, to Memphis and Chicago; and Pan American, to Guatemala and South America. These five connect New Orleans with only *five* communities in the state, but according to CAA there were *27* approved airports in the area at the first of this year.

These communities can be joined by fast, efficient, non-trunkline service through the issuance of area certificates under which the operators will not be tied down to restrictive and inflexible route-and-schedule patterns.

In the New York area the non-trunkline problem is somewhat different from that in Louisiana. Here, there is extraordinarily heavy trunkline air travel between New York and Boston, Buffalo, Pittsburgh, and Washington. But between these trunkline routes lie many smaller communities entirely without air service.

Regular trunk airline travel could not be profitably used in air communication for such short distances. For example New England and Eastern New York have 60 cities with populations ranging from 15,000 to 100,000, which do not have direct airline connection with New York City. Nevertheless, these cities, with a total population of about two million, have a definite community of interest with New York. Their residents come to New York as the principal wholesale market of the United States and the center for many business services, such as accounting, advertising, credit reporting, and finance, thus guaranteeing a continual exchange of traffic.

In addition to commercial traffic, the entire area is important as a mecca for vacationists and week-enders from New York City and its environs. Air service can add a day to a week-end and two days to a vacation. It is natural, therefore, to expect that, via air transport, the whole area will increase in importance as a resort and serve an ever-expanding market.

The above instances could be adapted in varying degrees to almost all the states in the Union. They are merely examples of situations which may be found all over the country.

Need of our smaller communities for air service is immediate. And the development of a flexible certificate fitted to the requirements of the non-trunk-line operator will be a definite step toward meeting this need.

Wall Street Eyes Planes

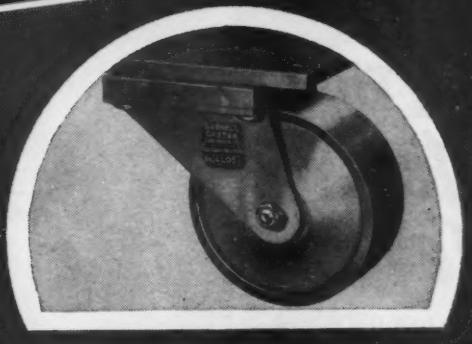
(*Continued from page* 179)

panies, such as Ryan and Luscombe, are still at the peak of their war operations and are thus in position to steadily enhance their financial position. Luscombe, for example, more than doubled production in the first 4 mo. of 1945 over the like 1944 period. Its first quarter sales were $2,637,000 against $1,205,000 a year ago. Ryan, announcing its unfilled orders a few weeks ago, placed this backlog at $116,000,000.

A number of personal plane companies, includuing Aeronca and Piper, have paid their first common stockholder dividends within the last year. Usually, the placing of these stocks on a regular dividend basis not only denotes a stabilized earning power but also makes the issues more attractive from the stockholder's viewpoint.

Procurement of loans for expansion and working capital is not the problem it was before the war for the small and middle sized company in any industry. We have had the Reconstruction Finance Corp. for more than a decade to furnish loans to railroads, banks, and

BUILT LIGHT TO CARRY HEAVY LOADS



Reduce Floor Wear to a minimum.

Increase efficiency of employees.

Eliminate wracking of equipment.

Save time, speed up production.

DARNELL
Casters & Wheels

DARNELL CORP. LTD., 60 WALKER ST., NEW YORK, N.Y.
LONG BEACH, CALIFORNIA, 36 N. CLINTON, CHICAGO, ILL.

Write for new FREE MANUAL

RADIO MEN!

The first time you listen with Murdock Phones, you know that here is clear reception with perfect comfort—and this is why:

1. MURDOCK "precisioneering" brings the message through naturally—without strain, chatter or distortion.
2. MURDOCK'S "solid-built" durable construction protects the fine, sensitive adjustments from shock.
3. MURDOCK'S "air-cushioned" phones provide long listening without head discomfort.
4. MURDOCK'S ventilation means cool comfort—prevents condensation.
5. MURDOCK'S two-way adjustment controls position for smoother performance.

Murdock's entire factory is now working for Uncle Sam. But as soon as victory is won, Murdock men, machines and materials will resume their peacetime position as a leading manufacturer of radio phones, telephone and electrical specialties for civilian use.

Plan for that peace now. ***Write today for new catalog.***

MANUFACTURERS: We're at your service to help you turn out more Radio Phones and related parts. Our organization has had 40 years' experience. Write us today.

WM. J. MURDOCK CO.
162 Carter St., Chelsea 50, Mass.

large corporations; but this agency didn't figure actively in the small business field. Now, however, Congress and the administration seem to be bending over backward to make sure small business is assured of all necessary working capital in the reconversion period and beyond.

The Opposing View

On the other side of the fence are those who see no reason for the investor to get interested in the personal plane stocks just because civilian production is being resumed. Nor are they impressed by merger possibilities. It is their curbstone opinion that the military plane makers have all the plants, facilities, and most of the organization they will want postwar. It will, they say, be a case of shrinking rather than merging. And the aircraft makers probably won't be interested in buying a name, since their tremendous war production and success of their fighting planes has made their own names household words in some cases and given them all the prestige they need to introduce any product they wish to manufacture.

Some astute Wall Street observers will tell you that their interest in the aircraft industry lies about 75% in military production, 15% in commercial transport output—and but 10% in the personal plane direction. In other words they feel that the aircraft industry must continue to rely on government orders for its "bread and butter" production for an indefinite period ahead.

At the same time, with the possible exception of a few companies like Douglas and North American Aviation, these observers expect that nearly all the big companies soon will make their bid in the personal plane field because of its acknowledged long-term future possibilities.

But, they reason, it's too early to get excited about those long-term possibilities. It is still a limited field with many new entries. And it will be a long time, they venture to predict, before there will be a Ford in the personal plane field. Planes must be simplified, in their view, so that the the average person can easily fly them.

Pres. W. T. Piper of Piper Aircraft Corp., largest prewar producer of private planes, made some observations to his stockholders last fall that are often quoted by those who are dubious regarding the immediate personal plane market. Declared Mr. Piper: "Technical improvements will make the postwar plane more useful than the previous models. However, it should be recognized that we do not have adequate airports and servicing facilities to accommodate a large number of air-

craft, and development of landing fields must go hand in hand with increased output of planes for civilian use."

Some Wall Street brokers take the position that it will be another year or two before the postwar pattern in the personal plane field begins to take shape. And remembering the casualties that took place in the automotive field after World War I, they counsel a "wait and see" policy. It was during the forepart of the motor car industry's greatest era of expansion that many of the producers disappeared. It is still too early, they contend, to pick the winners in the personal plane field.

Meanwhile, there's no denying that the personal plane makers are getting off to a good start in their reconversion to civilian production. They have garnered orders for thousands of planes with little effort, and they certainly have the draw at the start on their big potential competitors who are still concentrating on military work.

Piper Aircraft, for example, expects to produce more than 5,000 planes in its first year of resumed civilian output —almost as many personal planes as the entire industry produced in any year before the war. Aeronca has received more than 65,000 inquiries concerning both small airport operation and the purchase of light personal planes, and expects to begin delivering personal planes next month.

Recent market forecasts have predicted that around 20,000 personal planes may be produced in the lightplane industry's first full year of civilian production. Although this figure seems small in comparison with wartime military plane output, it is still some two and a half times greater than the previous peak.

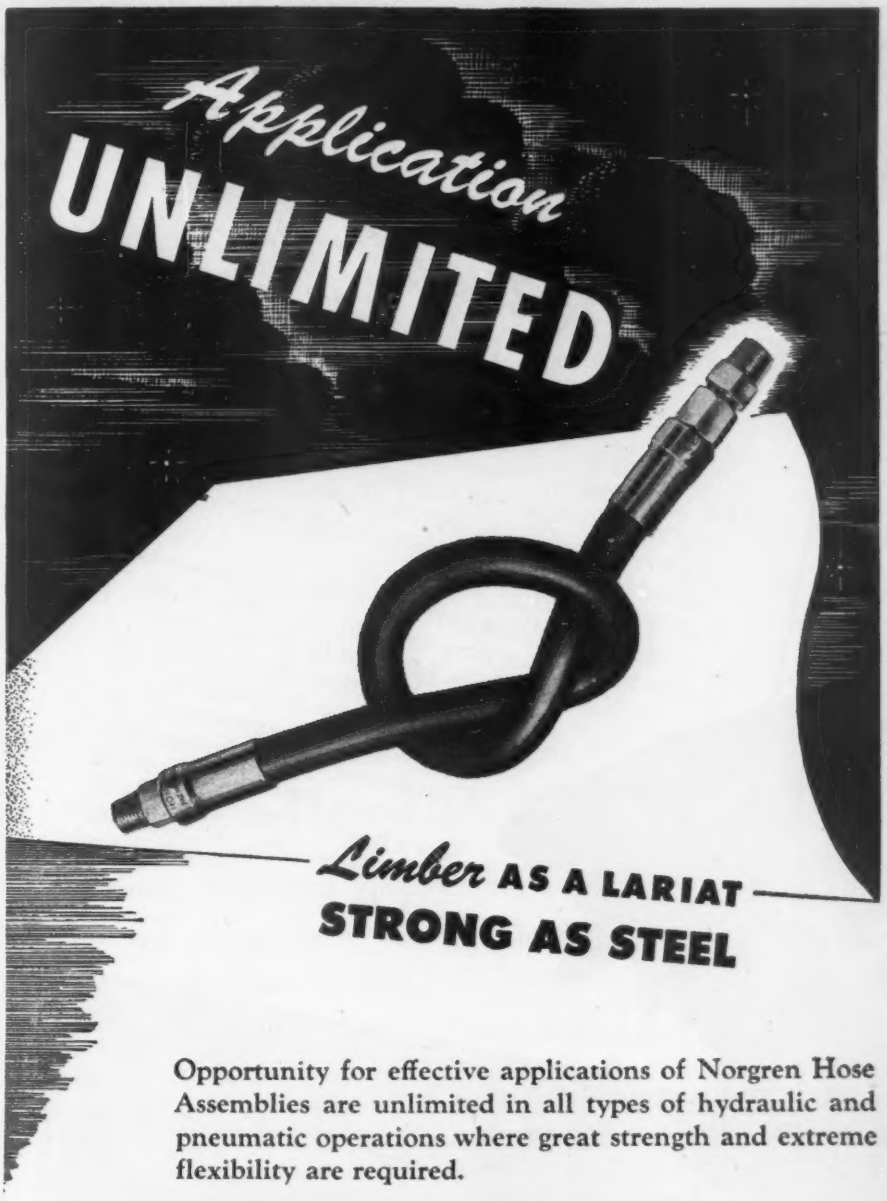
Tudor and New Aerovan

(*Continued from page* 177)

range of visibility. View here while taxiing is stated to be through 200 deg. and to within 10 ft. of the nose. The fuselage, affording a level loading floor, has a large single rear door to permit direct loading, or driving in of cargo. Straight-sided, maximum fuselage headroom is given as 6 ft. 6 in., with a storage capacity of 530 cu. ft.

Used as a passenger craft, light seats would be installed, permitting seating up to twelve passengers. Another arrangement could accommodate eight stretchers.

Wooden, cantilever wings, with 50-ft. span have Miles external airfoil flaps and slotted ailerons. The craft is 36 ft. in length, and height is 13 ft. 6 in. Weight empty is stated to be 3,000 lb., and maximum payload is



Opportunity for effective applications of Norgren Hose Assemblies are unlimited in all types of hydraulic and pneumatic operations where great strength and extreme flexibility are required.

OUTSTANDING FEATURES:

- Oil resistant synthetic rubber hose, reinforced with high tensile steel wire woven into the hose for maximum strength and positive passage even on short bends.
- Impervious to heat, cold, and solvent. Highly resistant to continuous vibration.
- Permanent machined couplings for high pressure and reusable couplings for low pressure.
- Recommended for working temperatures of —40° F. to 250° F.
- Available with I. D. of 1/4" to 1" inclusive, any length.

Write for new Bulletin No. 450. C. A. Norgren Co., 220 Santa Fe Drive, Denver 9, Colorado.

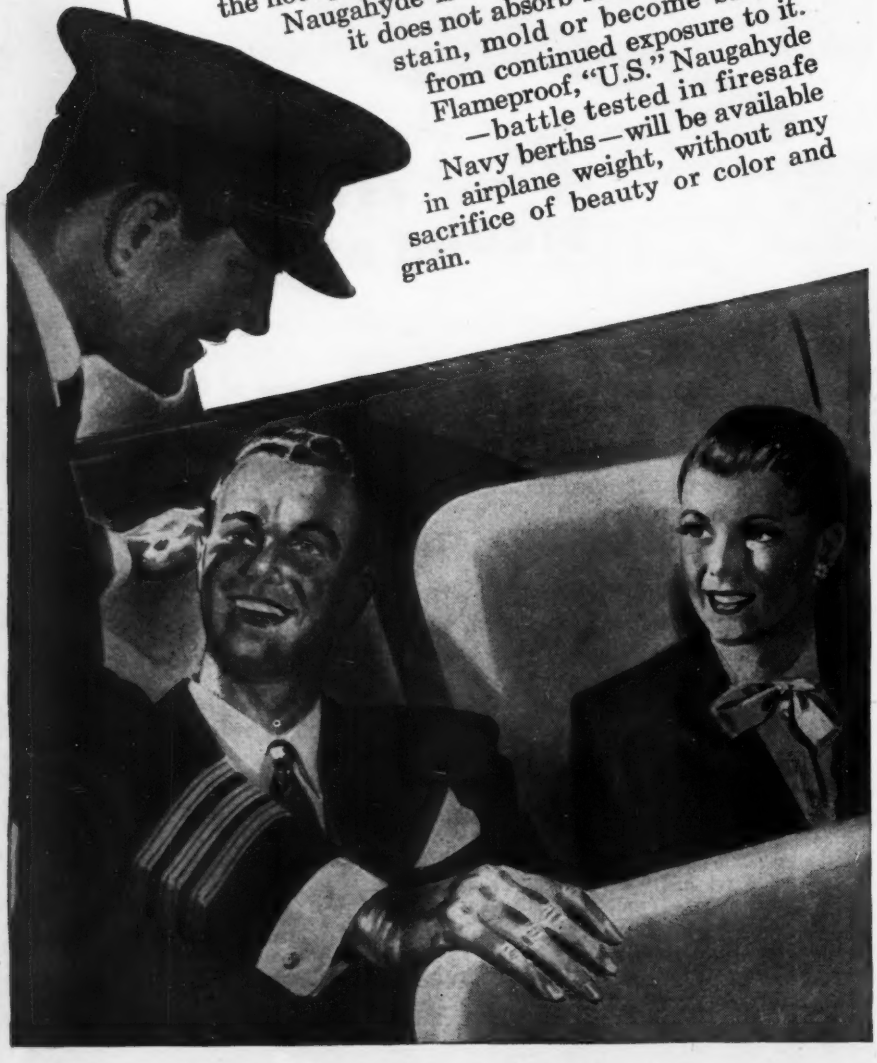
Norgren

FOR COLOR, QUALITY AND TEXTURE
THAT CAN'T BE SWEATED OUT...LOOK
FORWARD TO PERSPIRATION IMMUNE

"u.s." Naugahyde
REG. U. S. PAT. OFF.
upholstery

The coming "U.S." Naugahyde will have no rival in beauty of color and grain—in resistance to the wear and tear of capacity passenger loads on every flight—in adaptability for both seat upholstery and scuff-resistant decorative wall panelling.

And, no matter how long drawn out or severe the hot spell or how tropical the route, "U.S." Naugahyde is *immune* to perspiration—it does not absorb such moisture, or stain, mold or become brittle from continued exposure to it. Flameproof, "U.S." Naugahyde—battle tested in firesafe Navy berths—will be available in airplane weight, without any sacrifice of beauty or color and grain.



Soon, we hope, there will be new "U.S." Naugahyde available to you. All our facilities are still occupied in coating millions of yards of rayon, nylon and glass cloth for the Armed Forces.

UNITED STATES RUBBER COMPANY

Serving Through Science • COATED FABRICS DIVISION • *MISHAWAKA, INDIANA*

given as 1 ton. Fuel capacity is 50 gal., and with this, a range of 450 mi. is predicated. Performance figures include a 130 mph. top speed and a cruising speed of 115 mph., and it is also stated that the Aerovan can take-off or land within 100 and 260 yd., according to load.

Spartan 4-5 Placer

(*Continued from page* 175)

be able to fly from any moderate sized field, and will be capable of taking off over a 50-ft. obstacle in 1,055 ft. using 15 percent flaps. Further, it is specified that with 45-deg. flaps and brakes free, the Executive 12 would land in 1,989 ft., or with brakes locked, in 679 ft.

Price, in the present judgment, is estimated at under $20,000, although with fewer accessories, it may go down to about $14,000. . Size, performance, and price indicate that the Executive 12 is intended for companies which use private air transports, for the business executive, or for the advanced sportsman pilot.

Planning Overhaul Shop

(*Continued from page* 161)

standard structure, would not be quite so efficient for a continuous-flow shop but on the other hand would adapt itself to intermittent process overhaul without the expenditure of large sums of money. Changes may be accomplished quite easily, or the building may be sold to another organization without undue loss. Unless the operator contemplates an exceedingly large shop with continuous-flow overhaul, and feels called upon for the maximum of production in the minimum of time, it is not recommended that he invest a large portion of his capital in constructing a highly specialized building.

At this point it might be well to recognize the American business attitude that aims towards "room for future expansion".

With an airline, for instance, where engine overhaul is simply a factor in revenue cargo transport, it is quite possible to predict the rate at which overhaul facilities will need expansion to meet increased operating demands. For the repair station operator who regards engine overhaul as a revenue-producing end in itself, the business volume is far too dependent on external variables for him to pin down his rate of expansion over a period of years.

The writer recalls one such organization that provided itself with enough

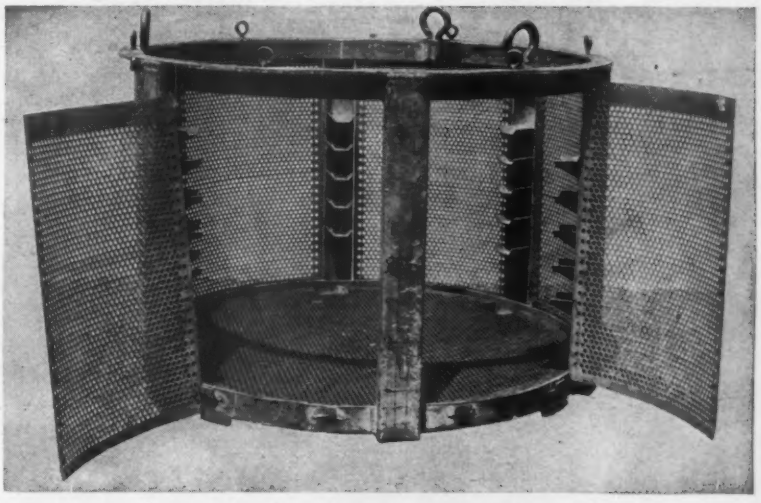
hangar space for a fleet of transport planes in spite of its relatively small market scope. Eventually, one corner of this magnificent structure was dedicated to the owner's hobby—raising goats.

A nearby competitor, on the other hand, was less sanguine as to his prospects. He set up business in a building so cramped that his hangar resembled the inside of an aircraft carrier. Prospective customers left the first hangar with an impression of an empty and dying business, whereas the second shop always seemed cozily busy in spite of the crowding. The common sense solution to the "future expansion" problem would appear to rest in a carefully thought out shop plan that will permit the incorporation of new processes without disruption. The aircraft engine starts its journey in disassembly, moves to cleaning and polishing, and continues through inspection, repair, subassembly, and final assembly, to regain its entity as an airworthy unit after test. Whether or not preservation and packing constitutes a true overhaul step is an academic question, but the overhaul manager will profit by giving engine preservation as much attention as he does any other shop function.

When the decision has been made to operate a shop within certain definite capacity limitations, it is time to arrange a tentative floor plan. Most shop superintendents will recommend a layout that eliminates irregular and unsystematic movements of engine parts as they go through the shop. Such conditions usually arise because operators are not cognizant of the basic overhaul sequence, or because the stress of daily business overrides their good intentions.

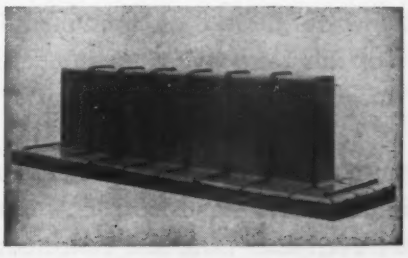
Shop superintendents who recommend a smooth flow of parts through the shop, are frequently thwarted in their attempts to achieve this ideal. On paper, a given layout might indicate a point midway between cleaning and repair as the best spot for inspection, but the building construction might make it desirable to place the inspection benches elsewhere to take full advantage of natural lighting. Floor load limitations, drainage, or ventilation, often point to a location other than the one theoretically desirable.

An excellent example is found in the cleaning department's location. While it is desirable to place cleaning near inspection, there are difficulties in keeping dust, vapor, and corrosive materials away from the clean parts and delicate instruments. Two solutions usually are offered: The first involves steps to seal the cleaning department from the rest of the shop and to ventilate to the outside air in such a manner



Skill and Experience Makes Possible Products Like These

Skilled craftsmen, endless experimenting, accumulated experience and the finest of materials combine to make Pressed Steel products the favorite equipment of engineers and designers everywhere.



Annealing Cover for general industrial use. Of light alloy, available in any size, shape or specification.

PRESSED STEEL COMPANY MAKE:

Carburizing and Annealing Boxes; Thermocouple Protection Tubes; Seamless Steel Cylinder Caps; Welded Alloy Tubing; Seamless Steel Neck Rings.

THE PRESSED STEEL COMPANY
OF WILKES-BARRE, PENNSYLVANIA

BRANCH OFFICES: 312 Curtis Bldg., Detroit; 503 Nicholas Bldg., Toledo; 1915 Engineers Bldg., Chicago; 51 E. 42nd St., New York; 1005 Sterling Bldg., Houston, Texas; A & M Accessories Ltd., 19 Melinda St., Toronto, Canada; Broad St. Station Bldg., Philadelphia; 318 North 8th St., St. Louis.

PRESSED STEEL COMPANY PRODUCTS: Carburizing and Annealing Boxes, Thermocouple Protection Tubes, Seamless Steel Cylinder Caps, Seamless Steel Neck Rings, Welded Alloy Tubing for High Temperature and Corrosive Application, Radient Tubes, Inner Covers and Base Sheaths for Steel Mills.

Saves 90% checking time

This instrument is a development of the engineering department of the Lockheed Aircraft Corporation.

Operates through CANNON PLUGS

One man, with this electrical tester, checks the hundreds of circuits of a big bomber in 2½ hours—a job that formerly took four men 12 hours. One of the speed-up features of this time-saving instrument is the use of Cannon Connectors to make and break and change the many complex circuits employed.

Cannon Connectors are used because they are rugged, accurate and dependable. Such is their construction that they stand hard use—even abuse. They maintain perfect contact even after long and continuous service. The dependability and versatility of Cannon Plugs adapts them to scientifically critical circuits on many types of electrical instruments. Cannon Connectors are made in thousands of styles and sizes. No other connector can be had in so many variations.

Write for this bulletin on Type K Connectors—an extensive Cannon line used widely in aircraft equipment. The plug pictured is a Cannon 90° Type K. Address Department A-110, Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles 31, California.

CANNON ELECTRIC

Cannon Electric Development Co.
Los Angeles 31, California

Canadian Factory and Engineering Office:
Cannon Electric Co., Ltd., Toronto, Canada

REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

that nothing will find its way back through open windows and doors. In the second system sandblast and chemical tanks are housed separately at some point well away from the shop proper, but if parts are wheeled from one building to another, protection must be provided against rain and dust.

Such items may appear trivial to the inexperienced operator, but a grain of sand in a master rod bearing may absorb a month's profits.

From the standpoint of accessibility a test stand just outside the final assembly shop door is best, but test stand noise is a handicap to employees contributing heavily to fatigue, irritation, carelessness, and also misunderstanding.

Continuing the discussion of shop layout problems, let us consider the subassemblies. Small engines do not break down into the extensive series of subassemblies common to larger engines. Subassembly build-up of a single rear section or nose section from a 2,000 plus hp. engine represents far more precision work than does the complete build-up of a 50 or 60 hp. lightplane unit. Moreover, the major sections will disassemble into secondary subassemblies, and each of these divisions requires a specific area for its construction. Obviously, a shop fitted to the needs of the lightplane owner, would be hard pressed to overhaul larger airline power plants.

Paradoxically, it may be wise to arrange the shop machinery in a manner that is quite inefficient with respect to the engine overhaul sequence. For example an operator owns an expensive piece of equipment whose capacity exceeds the requirements of the engine overhaul shop. By placing this machine where it is available to another department, he may be able to derive maximum utility from his investment. Many airlines group their machine shop equipment without considering the inconvenience involved in moving engine parts into the machine shop when that particular machine is needed. From the standpoint of engine overhaul, this is inefficient, but when fitted into the over-all picture, it is good business.

Work-in-process has been aptly tagged as "the graveyard of profits". New parts and high payroll charges represent money invested with no return until the job is paid for. If bottlenecks delay completion there is no chance of including all the interest on tied-up money in the customer's bill, a further stimulus for finishing jobs rapidly. There is also the problem of storing finished parts while waiting for other work. Storing requires labor for cataloging, requires storage areas and thus is a waste of space, and calls for

more man-hours to move the stored parts.

Two factors affect the completion of work: First, the general shop layout and equipment; second, efficiency of scheduling within the organization. Haphazard scheduling results in overloading a few machines while others are unused, also idle inspection or cleaning sections, while assembly or repair is swamped. Such occurrences incur unnecessary expense and careless work, and are likely to result in displeased customers. For these reasons, jobs in an overhaul shop should be as carefully scheduled as planes on an airline. The shop superintendent should know each job, its location, and stage of completion at all times. Nothing but chaos can otherwise result.

Let us examine the layouts of several typical overhaul shops. The shops in our accompanying figures are tied in with aircraft repair stations. The first diagram (Fig. 1) shows a typical small airline shop. This airline maintains 16 1,200 hp. engines with 30 men. The shop is 42x92 ft. overall. Engines enter at the upper right after removal from the airplane. Usually removed and placed on stands while in the main hangar, engines are occasionally trucked in. A two-ton monorail at the shop entrance handles such cases, as well as equipment and parts entering the shop.

Once inside, the engine is disassembled and the parts cleaned. Portable racks carry the parts to the centrally located inspection benches, or in the case of accessories, to a small separate shop with special equipment. The disassembly and cleaning section contains 900 sq. ft., the accessory shop 360 sq. ft., and the inspection department 504 sq. ft. When inspected, the parts move into the assembly area and are distributed to the respective repair sections. A special area is devoted to cylinder overhaul. The machine shop handles reworks and repairs of a general nature. Subassemblies are built up on the benches along the machine shop and stockroom wall. Final assembly is accomplished in the central area under the two monorail hoists.

Completed engines move into the hangar for mounting on a portable test rig. Final assembly requires 1,500 sq. ft., and the machine shop needs about 600 sq. ft. A stockroom at the extreme left offers a convenient supply of gaskets, small parts, and expendable items, while the centrally located office assures that no section is too remote from supervision. This layout is well-adapted to the custom shop type overhaul. The location of the inspection department might be criticized from the standpoint of poor natural lighting, but a carefully planned system of artificial il-

REX-FLEX ... "Tailor-Made" for Aviation!

• REX-FLEX Stainless Steel Flexible Metal Tubing was developed especially for the aviation industry. So it has the strength ... lightness ... flexibility ... high vibration qualities ... heat and corrosion resistance ... and pressure tightness that aircraft applications demand. In addition, REX-FLEX is manually bendable in multiple planes. Thus it can be fitted in place—installation is simplified, elbow fittings are eliminated.

C.M.H.'s complete aircraft line also includes Stainless Steel Bellows, Shielding Conduit, Avioflex Oil Line Hose, Cellu-Lined High-pressure Hydraulic Hose, and Avio-Tite Re-attachable Couplings. C.M.H. engineers are qualified by long experience to help solve your aircraft flexible metal hose problems. Write today for full details.

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CMH

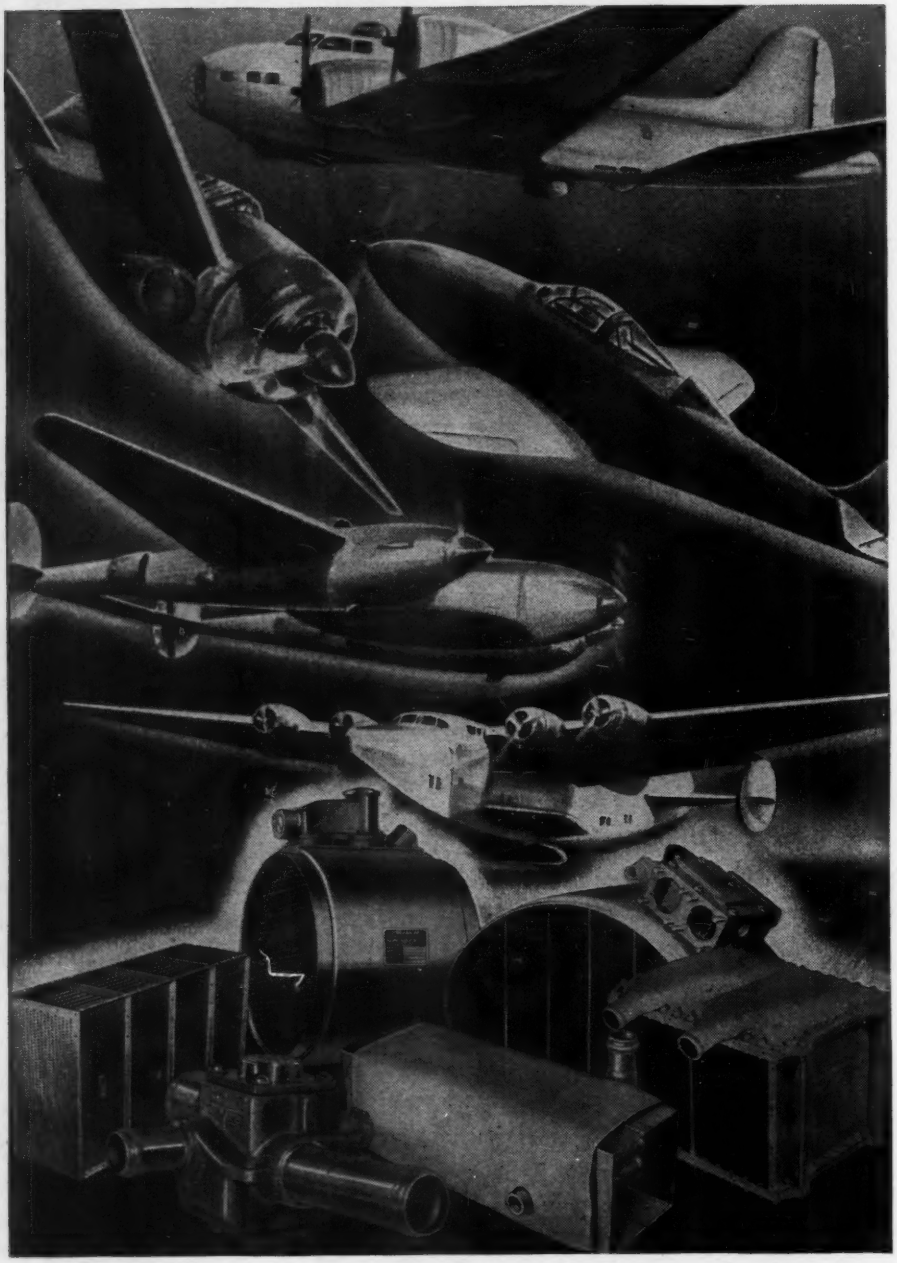
CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

HEAT TRANSFER SPECIALISTS

TO THE AVIATION INDUSTRY



Changes come fast in the aviation industry. New ideas replace old, and make new problems in heat transfer. For more than a quarter century, Young engineers have worked with aircraft engineers, solving new problems as they came . . . developing oil coolers, coolant radiators, supercharger intercoolers, cabin heaters and temperature regulating systems. That's why Young stands ready now with the experience and manufacturing facilities to design and produce special or standard heat transfer units for every need.

YOUNG

HEAT TRANSFER PRODUCTS

Oil Coolers • Gas, Gasoline, Diesel Engine Radiators • Intercoolers • Heat Exchangers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air Conditioning Units • Heating Coils • Cooling Coils • And a Complete Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR CO., Dept. 295-H, Racine, Wis., U. S. A.

Distributors: Pacific Airmotive, Burbank, Cal.; Aircraft Steel and Supply Co., Wichita, Kansas

lumination cancels out this difficulty.

Floor plan in Fig. 2 is representative of a private airplane and engine shop operated by two men in partnership. While not large nor extensively equipped, it has been a profitable and solid business in a brick building at the airport. A ramp allows medium sized planes to enter the somewhat restricted hangar space. At the opposite end of the building, a roadway connects with the main highway and with the railroad siding across the street. Parts, equipment, and customers enter from this side. One corner is occupied by a reception office, manager's office, record storage space, and washrooms. A swinging door over a small counter opens into the stockroom from the reception room. In addition to being a convenient arrangement for across-the-counter sales of parts, this permits a close linkage between the business office and stockroom. Paper work is thus handled quite directly and inventories of spare parts may be transmitted verbally from the stockroom directly to the books.

Machine shop equipment includes only basic tools and some special accessory test equipment. Inspection and repair are handled in this one room. A short distance from the main shop, two small metal structures house the cleaning and sandblasting operations. Fire and contamination problems from these two sources, serious in the small shop, are eliminated. One side of the hangar space is devoted to aircraft woodworking equipment; the other side provides benches for engine subassemblies, a small parts washing stand, and tool cabinets under the benches. Engine assembly and disassembly are conducted just outside the machine shop door underneath a monorail chain hoist.

This shop is an excellent representation of the unbalanced type of operation mentioned previously. As far as an organized flow of parts through the shop is concerned, no such facilities exist. Equipment does double duty for aircraft and engine work. The secret of making money in such a shop (and this shop has made more profit than many larger ones) lies in skilled personnel who are always busy. These men are accustomed to working together. They supplement each other's efforts without close supervision.

To be more specific, let us assume one mechanic is working on an engine assembly that requires the accomplishment of another mechanic's task before it can be completed. Rather than waste time waiting for this second operation to finish, the first mechanic will step into the airplane department for a few hours, or if his services are not needed there, he might go ahead with the fabrication of a special tool to add to the shop equipment. Such men, who

Photo of Boeing B-29 Superfortress courtesy Boeing Aircraft Co.

30-40-50 degrees and more below zero! That's how cold it is up where the B-29's fly. And our boys who fly them must be given every protection that science can devise to guard men against those paralyzing temperatures, to keep them as warm and comfortable as possible on their hazardous missions.

One of the most important means of getting such protection is the use of Fiberglas* Aircraft Insulation in the compartments and cabins. It helps keep heat in—cold out.

Fiberglas insulation, for aircraft of all types, is made of fine fibers of glass, bonded together into a flexible blanket form. It is so light that 20 square feet, one inch thick, weigh less than a pound! And this feature is carried through in service because the fibers, being glass, do not gain weight by moisture absorption, even under conditions of extreme humidity. Fiberglas is noncombustible, too.

This combination of properties, found only in Fiberglas, has given designers the weightsaving material they needed in aircraft, where every ounce is of vital importance.

Furthermore, these soft blankets of Fiberglas provide highly efficient *acoustical* insulation. The nerve-shattering high-pitched vibration noises and the monotonous drumming roar from the motors are dampened and absorbed.

These Fiberglas blankets are clean, chemically stable, resistant to corrosive vapors, are odorless and do not absorb odors.

Fiberglas in this and other forms is being used in the production of countless military and essential civilian products. Perhaps your products, or those which you are planning, can be made better with Fiberglas. Now is the time to get complete information. Write: *Owens-Corning Fiberglas Corporation, 1891 Nicholas Building, Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

Buy War Bonds ..for Keeps!

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

Circo Chief DEGREASER

When parts cleaning hours are whittled down to minutes, when the time wasted by a mechanic in cleaning parts is eliminated, when cleaning materials are salvaged, not thrown away—that's time saved and money made in parts cleaning. All of this adds up to the performance of the new, modern, remarkably fast "Circo Chief" twin tank degreaser—a "3 minute record" cleaner of dirty greasy parts, equalled by no other cleaning unit. It is by far the greatest advancement made in parts cleaning in twenty-five years. "Circo Chief" cleans parts five different ways; hot solvent vapor cleaning (automatic), drying (automatic), spraying (automatic), dipping and soaking. Method best suited for the job depends upon the condition of parts. Anyone can operate the "Circo Chief"—it starts and stops automatically, heats automatically, and feeds itself solvent automatically. All the operator does to vapor clean is feed it parts—the unit does all the cleaning. Solvent is non-flammable and all types of metal parts can be cleaned at the same time without any harmful effects.

This you can depend upon—the "Circo Chief" will clean and dry metal parts faster, more economically, more thoroughly with less effort, less of mechanic's time, at less cost than any other unit or method on the market. It will show bigger profit on each and every job. See it in action and you'll sell yourself—it's a revelation.

CIRCO PRODUCTS COMPANY
2835 CHESTER AVE. • CLEVELAND 14, OHIO

can see for themselves what needs to be done, are the backbone of a successful small shop.

Storage and warehousing facilities are sometimes an absolute necessity at an overhaul shop. If many engines must be stored, some thought should be given to a structure that will keep them clean and dry. Moreover, it is extremely important to make arrangements so engine boxes may be opened for periodic inspection.

To summarize, one basic rule is fundamental to setting up an engine overhaul shop: Decide what the business scope will be—then match the structure, equipment, and personnel to the business.

CAB and Airline Securities

(*Continued from page* 170)

railroad companies, generally, to secure the funds needed to provide the public with adequate transportation facilities.

The contrast of the over-all capital structure of the airlines with that of the railroads where complex capital structures and excessive debt financing through bonds are commonly encountered, is striking. It is true, of course, that the relatively small fixed plant and properties owned by an airline do not encourage much borrowing on a long-term secured basis, but this is perhaps an advantage in the long run. Equity or stock financing, which has in a measure been forced on the airlines, is particularly desirable in times of poor earnings, when a stoppage of dividends is accordingly all that occurs rather than failure to meet bond interest charges with consequent foreclosures. This is something that the railroad companies have, in many instances, learned too late.

As a general rule, transportation organizations of any kind, when overcapitalized, cannot earn a fair return on the face value of their securities. In such cases, however, it is a natural tendency on the part of these companies to pay interest and dividends and to use for this purpose money which is in part made available by the failure to properly maintain their properties. This has often been the situation among the railroads, but because of the small amount of airline capital invested in anything but operating equipment it is unlikely to become the case with these companies. It appears that the airlines, at least up to the present, are also immune to the possibilities of foreclosure due to defaults on bonded indebtedness.

The current capital needs of the airlines arise out of the necessity of keeping abreast of aeronautical ad-

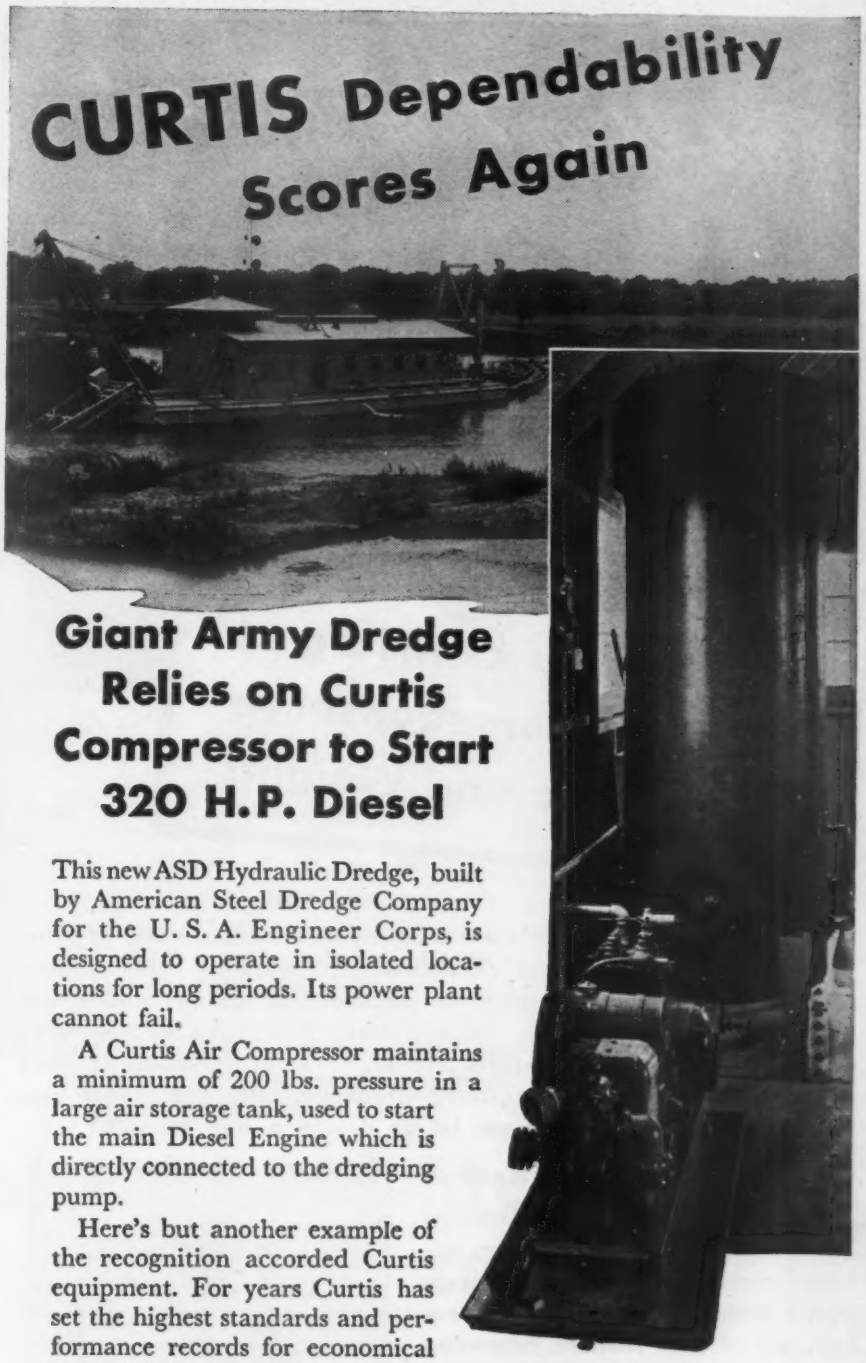
vance by the purchase of new transport and operating equipment. As time has passed, raising of capital by these companies has become less difficult, and the nature of their financial structures has become a favorable factor in this connection. For example, fewer shares of additional stock can be sold at higher prices to obtain required money, leaving capitalizations still relatively small and simple. Raising of additional capital is aided by the fact that new funds go directly into flying equipment which almost immediately produces revenue.

The airlines are not faced with the problem of making huge outlays for land, roadbeds, tracks, bridges, and the like, as were the railroads. Even when new routes are obtained by an airline, practically the only capital cost may be for additional flying equipment and some airport and traffic solicitation expense. It is likely that for some time to come the financial needs of the airlines, as well as those of the manufacturers who sell them equipment, can be met through the use of the chattel mortgage, the conditional sales contract, and the equipment trust certificate.

To be sure, as the CAB points out, the ICC was given the power to regulate railroad securities by the Transportation Act of 1920, but it must be remembered that this grant of power was not an enactment standing by itself but was, instead, an integral part of a comprehensive system of regulation of interstate commerce and interstate carriers. At that time, Congress rightly considered that the most essential and vital object of regulation was to bring about an adequate transportation service, and that the credit of the railroads was the foundation upon which service of these carriers rested.

That such credit might be reestablished, after the period of Federal operation of the railroads, and further strengthened and sustained, Congress adopted several measures among which was the regulation of securities issues. Such regulation was, therefore, provided by Congress not solely for the protection of investors, nor for the express purpose of avoiding conflicting State regulations, but as a necessary part of the constructive program whereby the Transportation Act of 1920 sought to build up the nation's railway systems so they would be prepared to carry an increasing amount of traffic.

No comparable situation as to the airlines exists today. Instead of being financial wrecks with an unsavory financial background, the airlines are in an excellent financial position with no such history as had the railroads.



Giant Army Dredge Relies on Curtis Compressor to Start 320 H.P. Diesel

This new ASD Hydraulic Dredge, built by American Steel Dredge Company for the U. S. A. Engineer Corps, is designed to operate in isolated locations for long periods. Its power plant cannot fail.

A Curtis Air Compressor maintains a minimum of 200 lbs. pressure in a large air storage tank, used to start the main Diesel Engine which is directly connected to the dredging pump.

Here's but another example of the recognition accorded Curtis equipment. For years Curtis has set the highest standards and performance records for economical dependability throughout a long, trouble-free life. Here are some reasons why:

✓ TAPERED ROLLER BEARINGS
✓ CENTRO-RING LUBRICATION
✓ CARBON-FREE DISC VALVES
✓ AUTOMATIC PRESSURE UNLOADER
✓ PRECISION CONSTRUCTION THROUGHOUT

Write for our bulletin, Form C-4-C.

CURTIS
ST. LOUIS
NEW YORK
CHICAGO
SAN FRANCISCO
PORTLAND

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1957 Kienlen Avenue, St. Louis 20, Missouri

F-442

Please send me bulletin, Form C-4-C.

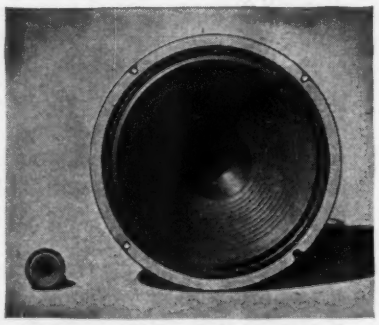
Firm.....
Name.....
Street.....
City..... .....Zone.. .....State.....

Permoflux Midget Transformers Conserve Vital Space and Weight!

● **Because of their exceptional operating efficiency and uniform frequency response characteristics, Permoflux midget transformers have literally hundreds of practical applications where size and weight are determining design factors. Developed by Permoflux engineers, with new materials and manufacturing methods, they are available unshielded, shielded or hermetically sealed for your specific requirements. Why not let us design a unit for you?**

Permoflux Speakers Assure the Best in Tone Reproduction

Their wide frequency response, extreme sensitivity and rugged mechanical design have established new concepts of tone realism. Permoflux speakers in sizes from 2″ to 15″, with power handling capacities from 1 to 20 watts, are available for your post-war developments.

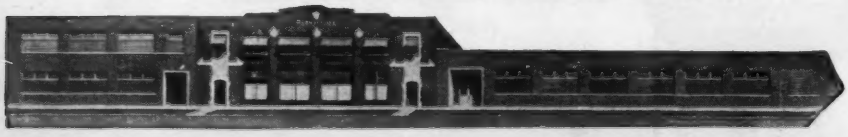


TRADE MARK

PERM-O-FLUX

PERMOFLUX CORPORATION

4900 WEST GRAND AVE., CHICAGO 39, ILL.



PIONEER MANUFACTURERS OF PERMANENT MAGNET DYNAMIC TRANSDUCERS

In fact the existence of the Securities and Exchange Commission, something unknown when the railroads were passing through their financial vicissitudes, is probably all we need both now and in the future to protect investors and the airlines themselves.

And since the airlines may meet their financial needs by the comparatively simple methods mentioned above, the question arises as to whether there is any real need for the CAB to be granted an additional regulatory power over the airlines, such as the Board now requests. Certain objections may be raised to this type of control, as follows:

1. CAB control would place the airlines in such a position that they would probably be unable to take advantage of favorable situations in the money market. Changes in this market are often sudden. An airline could not act as quickly as it can now to take advantage of some favorable opportunity, if the securities to be sold had to have, in advance of sale, approval of some public body other than the SEC. Such approval could only be given after investigation, which would, if previous experience in CAB matters is any criterion, cause material delay.

All government regulation tends to bureaucracy, delay, undue expense, and waste of time by all parties concerned. No matter how simple the case, a day must be set for a consideration of each one by itself, and ample time must be allowed for each. Any government bureau is handicapped in expediting its business, because care must be taken lest it fail to give everyone interested an opportunity to be heard, due to fear of criticism by Congress; and, also, lest through a short cut it might be guilty of an error of judgment for which criticism might result.

2. CAB control could be objectionable because it might tend to mislead investors and thereby injure instead of benefit them. If the CAB should, for example, fix a minimum price for an issue of stock or possibly bonds (if the airlines should ever have to resort to this type of borrowing), it would thereby appear to place its approval on their value. Many investors would buy securities because of faith in the Board's judgment. It might well soon develop, however, that the Board could make mistakes. There would be many cases where securities could not yield the expected returns or long command the established price in the market.

Judging, however, from experience of the ICC in regulation of railroad securities this may not be a very strong

argument. In the case of railroad stock and bond issues, investors have not relied very heavily upon the judgment of the Commission. In fact, a survey conducted by the writer revealed that very few investors knew that the ICC had anything to do with the railway securities they were buying. The same lack of understanding was also true regarding the average "commercial banker" (as distinguished from the "investment banker"). Correspondence with a large number of members of the American Bankers' Assn. revealed the fact that many, while they knew of the work of the Commission in rate matters, were entirely unaware of its work in connection with railroad securities.

3. CAB control would tend to restrict airline enterprise and foster further paternalism in government by transferring too much detailed authority over these carriers from their responsible managers to public officials. There might easily be an increase in the unfortunate tendency, already noticeable, for the Board to encroach upon functions of actual airline management.

In defense of the Board it should be recognized that it is often difficult to say just where regulation leaves off and management begins. So many of the activities of the airlines are today directly under the control of CAB that the area left open for free action of the boards of directors of such carriers is considerably limited. Of this area left clear for free action the part devoted to questions of finance is perhaps the largest, and surely not the least important. It would seem to be the best policy for the Board to refrain from entering that field, other than upon the clearest evidence of public necessity for so doing. Unless the management of an airline proposes a course of action which is clearly opposed to public interest, the Commission should refrain from interfering with the management's judgment.

Congress has relied upon private management and enterprise for providing an efficient air transportation service. This would seem to imply that the Board, in carrying out the regulatory task, should leave all possible scope to the carrier's managers, subject to considerations clearly affecting public welfare.

Review of Patents

(*Continued from page* 198)

for connecting propeller and engine, a clutch arrangement to enable propeller to act as flywheel to drive engine, and means for governing rate of rotation of propeller when it is connected to engine by torque converter or automatic clutch. —2,377,457, filed July 5, '41, pat. June 5, '45, same inventor and assignee.

it's HARRIS MOUNTS

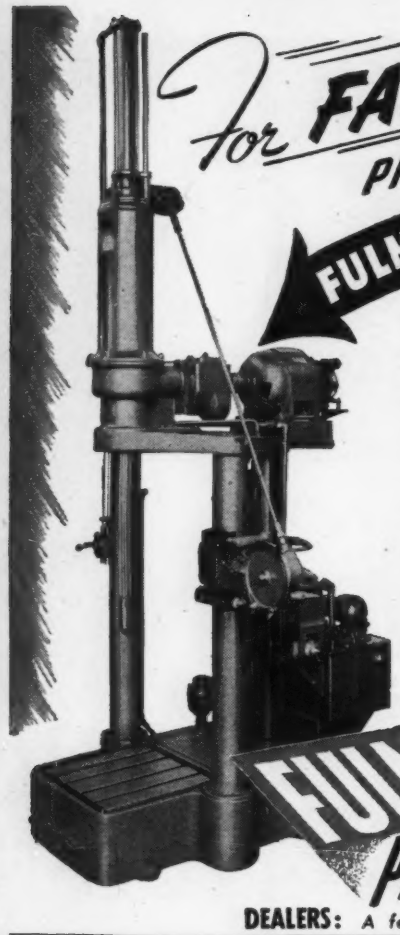
It is impossible for delicate instruments such as those used on planes, radios, or in the electronic field to take jars, jolts, shocks, and vibration and still maintain their accuracy or function efficiently for any length of time.

Harris Mounts cradle, cushion and protect instruments by absorbing up to 90 per cent of this "rough going" which is the death knell to sensitive precision made-instruments.

Harris mounts are rugged, yet, extremely light in weight. They are made in accordance with Army-Navy standards to suit any combination of weight, frequency, deflection, or operating condition and come in plate and cup form. Send in for free Bulletin Series 1022, giving complete data on Harris Mounts.

Our engineers, long experienced in the field of engineered vibration control, will gladly work on your problem with your engineers. Just drop us a line.

HARRIS PRODUCTS COMPANY
CLEVELAND 4, OHIO, U.S.A.



For FASTER PRECISION HONING....

FULMER HONING MACHINE

THE Fulmer Honing Machine produces round, straight, smooth bores to working tolerances as small as .0002". It is an extremely flexible machine. Due to a wide range of spindle and reciprocating speeds, it removes material **faster than any other known method for a comparable degree of accuracy and surface finish.**

It is ideal for finishing aircraft cylinders, connecting rods, Diesel, gas and compressor cylinders, supercharger parts, landing gear struts, recoil cylinders—wherever superfine cylinder surfaces and extreme accuracy are required. Write today for complete information.

C. ALLEN FULMER CO.
1225 First National Bank Bldg., Cincinnati, Ohio

FULMER PRECISION SERVICE EQUIPMENT

PISTON RING LAPPERS
SPECIAL MACHINERY
HONING MACHINES
ROD BORERS

DEALERS: *A few attractive territories remain open. Write today!*

the NAME on the REPORT COVER
TRIPLETT & BARTON INC.
DOES make a difference.
Especially when it represents the experience gained in pioneering varied testing techniques for aviation.
FOR COUNSEL WRITE OR CALL
Triplett & Barton
INCORPORATED
KNOWN FOR THE BEST IN TESTING METHODS
BURBANK, CALIFORNIA
SEATTLE, WASHINGTON
WICHITA, KANSAS

Radio Guiding System for Aircraft is intended to facilitate concealment of landing fields by providing direction via intersecting beams in various zigzag paths. Remote main radio-beam projecting stations guide craft home from distant points, and landing field beam apparatus directs plane to field, directive beams being progressively weaker as field is approached and beams projected being relatively weak and of short range, not likely to affect receiving apparatus of enemy craft.—2,378,242, filed Aug. 3, '42, pat. June 12, '45, W. M. O'Neil.

Tow Target cable shearing is eliminated by providing removable insert member for lead cable ring having limited opening through which cable passes to guide ring to position opposite release mechanism. Latter, when struck by insert member, forces this member from position in ring.—2,376,754, filed June 21, '43, pat. May 22, '45, A. E. Brickman, assignor to The American Steel & Wire Co. of N. J.

Aircraft Stabilization and Control, independent of usual elevators, rudder, and ailerons, is obtained by utilizing variation of thrust, either in direction, intensity, or both. Wings or other surfaces of craft are provided with tubes disposed transversely, formed and positioned so that very thin layers of fluid are caused to issue at high velocity from narrow slits to produce required thrust in direction of flight.—2,376,834, filed Oct. 6, '42, pat. May 22, '45, N. A. Thompson.

Direct Propulsion of Aircraft is attained by charging a chamber with a relatively large volume of air, exploding relatively small charge of fuel within chamber, and then expelling air and products of combustion by force of explosion to propel craft directly by reaction of air current so produced. Explosions take place in rapid succession, with expanding gases acting directly on successive bodies of air supplied to combustion chamber.—2,377,247, filed Dec. 9, '41, pat. May 29, '45, E. Lagelbauer.

Landing Gear Wheel Rotation prior to landing is accomplished with gear box, stub shaft for wheel actuation, ratchet sleeve and gear attachment for connecting shaft to wheel, oppositely acting electromagnets for engaging and disengaging sleeve, and motor connected to stub shaft by flexible shaft.—2,376,621, filed Sept. 14, '44, pat. May 22, '45, M. L. Reed.

Recent Books

(*Continued from page* 198)

row," says Mr. Litchfield, "will be more exciting, more important, and fuller of opportunity than any we have known." There is, he continues, a consumer body "comprising 200 million people whose wants are all but inexhaustible, limited only by the ability to pay. . . The market is unlimited because the sum total of human wants can never be satisfied."

COASTS, WAVES AND WEATHER, by John Q. Stewart. Ginn & Co., Boston, Mass. 348 pages, photos, index. $3.75.

Here, the entire physical background of navigation and avigation is considered. The treatment is comprehensive and graphic, affording much material for instruction and reference.

HOW TO SPEED UP SETTLEMENT OF YOUR TERMINATED WAR CONTRACT, by J. K. Lasser. McGraw-Hill Book Co., New York City. 186 pages, graphs, index. $3.50.

Designed to apprise executives of both small and large plants regarding correct steps to initiate when war orders are cancelled or curtailed, this volume includes a full guide to subcontractors on procedure and the maintenance of maximum protection.

NO INFLATION COMING, by William J. Baxter. International Economic Research Bureau, New York City. 84 pages, drawings. $1.00.

This is a review and developed exposition of American economic affairs, featuring the premise that no inflation may be expected, holding that money in the bank and war bonds will remain sound, and forecasting cheaper common stocks, farms, real estate, and various commodities in postwar.